Volume 126 New York, July 14, 1928 *Number* 2

ENGINEERING AND MINING JOURNAL

A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

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NEW YORK District Office, 285 Madison Ave.
WASHINGTON, National Press Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 1600 Arch Street
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

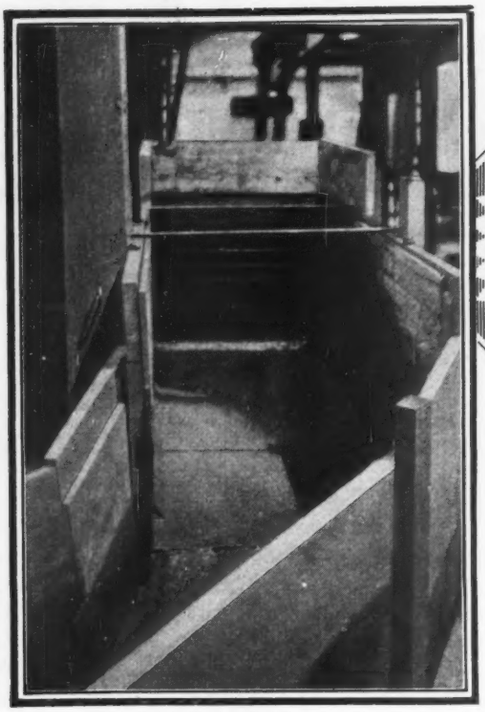
Cable Address: "Machinist, N. Y."
Copyright 1928
By McGraw-Hill Publishing Company, Inc.
Publishers of
Engineering News-Record **American Machinist**
Power **Chemical and Metallurgical Engineering**
Coal Age **Engineering and Mining Journal**
Ingeniería Internacional
Electrical World **Electrical Merchandising**
Bus Transportation **Electric Railway Journal**
Construction Methods **Radio Retailing**
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

The subscription rate in the United States is $6 per annum, including postage. United States possessions, Canada, Mexico, and the countries of Central and South America, $7.50 per annum, including postage. All other countries, $10 per annum, including postage. When a change of address is to be made, the new and the old addresses must be given. Notice must be received at New York at least ten days before the change can be expected to take place.

Published weekly. Entered as second-class matter, June 20, 1879, at the Post Office at New York, N. Y. under the Act of March 3, 1879.

Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

11,299 Copies Printed This Issue **Total Number of Issues to Date, 3,238**



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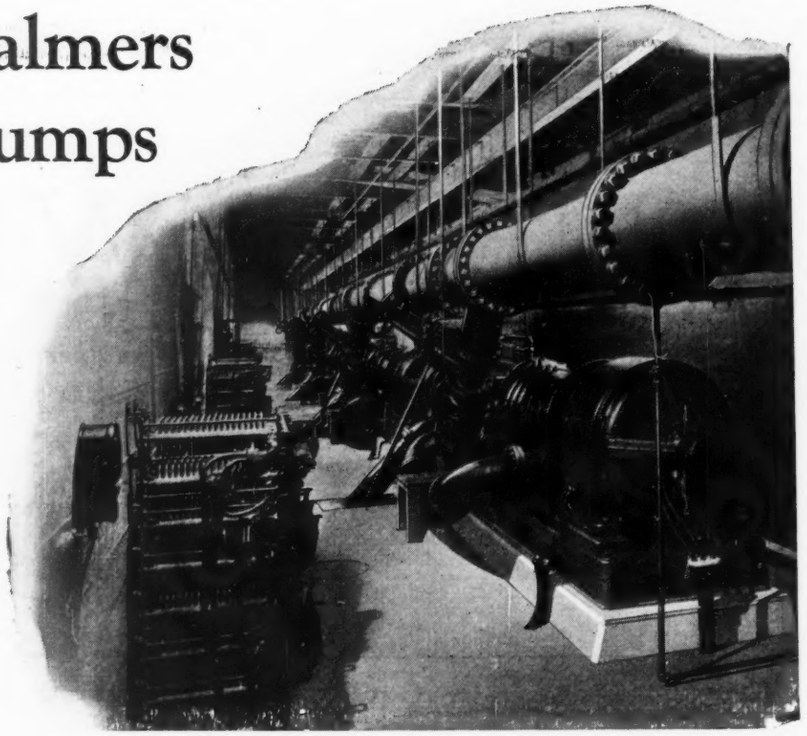

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ENGINEERING AND
MINING JOURNAL

McGraw-Hill Publishing Company, Inc.
JAMES H. MCGRAW, *President*

A. W. ALLEN, *Editor*

VOLUME 126 — *New York, July 14, 1928* — NUMBER 2

In Re "De Re Metallica"

IN ITS ISSUE of July 9, the New York *Times*, in a leading editorial discussing a recent pronouncement of Dr. Hubert Work, Secretary Hoover's campaign manager, states:

"His [Dr. Work's] last deliverance is that 'we shall meet the issues as they arise.' One issue has already arisen to embarrass Secretary Hoover. It is whether he desires to have an indiscreetly talkative National Chairman. Perhaps the phrase is not to be found in the work on agriculture which Secretary Hoover translated from the Latin, but he might send it along to Chairman Work to paste it in his hat: 'Labor non verba.'"

Agricola's *"De Re Metallica"*—a work on agriculture! One wonders if the writer of the editorial in question knows anything at all about Secretary Hoover and his achievements.

Mining News and the Editorial Viewpoint

A SUBSCRIBER has suggested that it would be desirable to incorporate in our news stories some editorial comment reflecting the views and ideas of the publication with respect to each particular item. Two obstacles to the plan suggest themselves: First, that the establishment of a technical staff capable of verifying all the mining news of the world would be impracticable; and, second, that such a policy would be contrary to the recognized philosophy of journalism, which draws a sharp distinction between "news" and "editorial matter."

The difference, broadly speaking, is that the essence of news is fact, whereas that of editorial is opinion. It is true that editorials should be based on fact and that the news columns contain much that is largely opinion—but the opinion must have been expressed recently by an individual of such qualifications that his views may be regarded as "expert." The circumstance that he has made the statement is news in itself.

If Senator Blank, after "a careful survey," assures Governor Smith that he has a better-than-even chance to become the next President of the United States, the New York *Herald Tribune* will print this as news. Editorially, it may take occasion to point out that Senator Blank is probably suffering from the heat. Similarly, if the general manager of Silver-Gold Prince Mining declares that his company has opened a large body of $20 ore, plans to sink the shaft 300 ft. deeper and to build a cyanide plant, his statement is news; and unless he is a notorious fraud the item is entitled to publication in *Engineering and Mining Journal*. Obviously, it would be impracticable for the editor to employ an engineer to check up the disclosures made by recent development, to sample the mine, and to reach an independent opinion as to whether the statement of the manager was conservative or extravagant, or if the erection of a mill appeared to him to be warranted. If a reputable mining company install a new hoist and other surface equipment, the announcement is legitimate news, even though no ore has been uncovered and even though the editor is thoroughly convinced that geological conditions are unfavorable for finding ore. The shares of X.Y.Z. Mining may jump from 50c. to $10 on the stock exchange; this is news, even though one may feel sure that the advance was caused solely by manipulation. Such an opinion might properly be expressed in the editorial columns, but it has no place in the news.

Engineering and Mining Journal strives for accuracy in its news columns, as elsewhere in the paper. It seeks to know the source of items it publishes, and it rejects much that is sent because of doubt as to authenticity. Censoring the news, however, is not its function; and it never suppresses matter simply because the facts are disagreeable or displeasing to the editors or to any influential portion of the industry it serves. It comments often in the editorial columns on news printed in the same issue or in other issues. Possibly this has not been done often enough; which suggests opportunity for careful introspection, to ascertain if more frequent comment is advisable. From this standpoint, the suggestion of our subscriber-friend is welcome, as are all suggestions for improving the service to the reader.

The Latest Hundred Million Dollar Mine

RECENTLY the stock of Noranda Mines, Ltd., crossed sixty dollars per share. With an outstanding capitalization of 2,168,566 shares, this represents a stock-market valuation of well over a hundred million dollars, which makes it, next to the Bingham mine of Utah Copper, the most "valuable" mine in North America. In fact, few large mining companies, even among those having widely diversified interests, surpass Noranda in market value: Anaconda, Kennecott, Utah, American Smelting & Refining, International Nickel, and Consolidated Mining & Smelting alone, of American mining corporations, are valued higher by the investing public. The famous Hollinger shrinks well into the background, being valued at only seventy million.

Last January the ore reserves of Noranda contained about eighty thousand tons of copper and six million dollars' worth of gold—certainly nothing to justify anything like the present valuation. Since then, more high-

grade ore has been developed at depth, the amount of which has not been announced, but about which speculation has been rife. Even assuming that the ore reserves of six months ago have been doubled, the value of the property, based on known assets, would not be more than a third of its present valuation in the market. Plainly, the speculative public thinks it has found a bonanza, with unheard-of wealth waiting only to be discovered by the drill.

Well, why not? Seven years ago the name Noranda was meaningless, and the Horne claim, as well as the whole Rouyn mining district of Quebec in which it is located, was unknown to the hundreds of prospectors that had been roaming over the North for years. Six years ago it was nothing but an undeveloped outcrop. Five years ago the Quebec Superintendent of Mines, speaking of the district, stated that "nothing spectacular has come to light." Not until three years ago did development reach the stage when a smelter began to be talked of; the stock, then closely held, was valued at around seven million dollars. Less than a year ago was the producing stage reached and a smelter blown in.

Who can deny the man in the street that five, or ten, or a hundred times as much ore may be discovered in this phenomenal deposit as has already been found? The speculator must speculate, and who can blame him for taking a chance here, where the management may be presumed to be honest and where the ore is known to be rich, rather than in some unknown wildcat? Mining is never just a stodgy business, but not often can it boast of a romance like this.

And yet, one may well suspect that those who are gambling in this stock are not romanticists so far as the ore is concerned. They are, rather, market romanticists, hoping that the price of the stock may continue to climb and that they may get out at the top. Which, as we all know, is a dangerous game.

State and County Taxation in California

THE unsatisfactory situation that exists in regard to the taxation of Mother Lode gold mines was discussed at a recent meeting of the mining department of the Sacramento Chamber of Commerce. It was pointed out that quartz and placer mines have limited lives, a fact that should be considered in making valuations. Also, the cost of mining increases with depth. A working mine is a great asset to a community, whether or no it is working at a profit, and the valuation of property in mining towns depends on conditions at the mines. When they cease to work, the people move away, the stores close, and the district becomes "dead."

The payroll, and local purchases, keep these towns alive. Three contiguous gold mines in Amador County spend annually about $1,500,000 locally. Without the payrolls of near-by mines, the towns of Jackson and Sutter Creek would soon be dead, and the trade with Sacramento would cease.

Assessors seem to have no fixed rule in valuing a mine. The taxation levy appears to be in the nature of a guess as to what the company can afford to pay. A State Board of Equalization or a permanent State Tax Commission is needed. Most of the taxpayers, as well as the county assessors, would probably favor the fixing of all property valuations by such a tax commission. Valuation of mine property should not be fixed higher than that of other property of the same selling value, as determined by a willing buyer and seller. That is, the tax valuations should be made so that every kind of mine property bears its due and proper share of the tax burden, regardless of the tax rates fixed by the authorities. A tax commission, when valuing mining property, should also consider what tax valuations are placed on other kinds of property, so that there may be no unjust discrimination against mining properties.

The constantly increasing county tax burden in California has forced the suspension of many gold mines in that state. The time has come when it is desirable to insist that property valuation for taxation should be made by an impartial, competent, and permanent state board, such a board not functioning as its prime purpose to increase the state revenues, but working to prevent unjust and illogical discrimination between the mining and other industries.

The Relation of Ethics to Employment

IN CONTRADISTINCTION to practice in many other callings, the professional activities of a mining engineer are not governed by an official code of ethics. Consequently, he must, in professional and business relations, depend for guidance on his own moral conception of what is right and what is wrong. Some there are who dwell on the borderland of shady deals, who measure their actions by what they can "get away with"; such individuals would be but little influenced by so intangible a barrier as an ethical code, though the establishment and general acceptance of a standard of professional behavior might do much to discredit them.

To the reputable engineer, opportunities frequently arise to decide on points of ethical conduct, and it is not inconceivable that contrary opinions might be held on the same subject by two equally upright and outstanding members of the profession. Such instances are common in the experiences of every active engineer. Substantial benefit would accrue to the profession from the compilation and cataloging of the experiences and decisions of its prominent members, for the guidance of the younger and future members. The difficulty is to get weight behind such a proposal, and to secure the sanction and active support of the proper individuals and agencies.

The following incident is suggestive of a dilemma in which any member of the profession may be placed: An engineer was engaged to remodel and place in successful operation the concentration plant of a small mining company. Meeting the officials before proceeding to the property, he made the usual queries as to ore available, financial structure of the organization, and other matters of technical and economic importance. He was assured that the property had a large tonnage of ore blocked out and broken in the stopes, that the company was completely financed, and that the only possible difficulty foreseen was in getting the plant into operation. This being the specific job for which he was engaged, his responsibility might well have been considered as limited to the proper execution of that task.

However, on arriving at the property and getting his work under way, his curiosity was aroused concerning

the nature of the ore, of which the company officials, all small-town business men, were so confident. His peregrinations through the underground workings revealed a considerable tonnage of broken rock, but it did not look like ore. On questioning the officials at a subsequent meeting, vague references were made to the opinions of the locators of the property and to "reports" submitted by local men. An exuberant spirit of optimism was in evidence. Whereupon he secured samples from the stopes for assay. The results bore out his fears: the material was almost worthless. Armed with this information he recommended to the company officers that they discontinue work on the plant and center efforts on a development campaign, or accept his resignation. Needless to say, his resignation was accepted; and a substitute, less particular as to the manner in which his employers spent money, was secured to direct the completion of the plant. When finished, it was operated for three weeks, treating about one thousand tons of "ore" and producing one ton of low-grade concentrate, whereupon it was shut down. The owners were sadder but wiser men. The engineer's judgment was vindicated, although little credit came to him for his courageous attitude.

In this instance, the engineer lost profitable employment by carrying his investigations beyond the immediate work for which he was engaged. Would it have been ethical for him to neglect the matter of an ore supply and devote all his attention to building the mill? Or would it have been ethical for him to continue the erection of the concentrator even though he was of the opinion that no ore was assured on which it could be run? It would appear that the answer to the first question would be "Yes, but it would be a reflection on his engineering ability not to take steps to assure a profit for his employers, to the extent, at least, of questioning the matter of ore supply." The answer to the second question depends on the financial structure of the company. If the engineer is convinced that the mill is to be nothing but "window dressing" for the sale of stock to the uninitiated, his resignation would certainly seem to be well advised.

Progress in Welding Inspires Confidence

OPINION based on theoretical considerations is often proved wrong by practical results. Welding, for instance, seems unreliable to many, especially where the welded joint cannot be readily tested. For this reason some regard welded structures as unsafe, and talk dubiously of the risk entailed by the resultant crystallization of the steel in the vicinity of the weld. Such crystallization undoubtedly occurs under some conditions. What engineer, then, would specify welding instead of riveting for a steel construction job? But facts are facts. Not fewer than eighty-five welded structures are already in existence. The list, which is given by Professor Frank P. McKibben in the July issue of the *General Electric Review,* includes eight bridges, forty-three buildings, three cars, two cranes, six frames and towers, twelve ships and allied structures, and eleven tanks.

The shop man's experience with welding is also worth considering: At the outset he lacked confidence in it, but as job after job has proved successful, his faith has grown, until today he is likely to be the strongest advocate of welding in an organization.

Concentration as an Important Adjunct to Cyanidation

THE BASIC PRINCIPLE underlying the concentration of a gold ore prior to cyanidation is entirely sound, but the application of the idea has proved difficult if not uneconomic in several instances. Mr. E. H. Johnson, of the consulting staff of Rand Mines, in a paper published in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa last year, cited the failure of those who sought to treat banket ore by concentration on Frue vanners or shaking tables, followed by the cyanidation of the rich material. Technical results were promising, but these were offset by high cost. Flotation failed likewise, as an alternative to gravity concentration. The capacity of the unit or process was too small in relation to capital and operating expense involved, and other disadvantages were evident.

Mr. Johnson has kept in mind the need for the concentration of large tonnages of material at a low cost. His researches led to the development of a new concentrating device, which consists of a revolving cylinder, through which the pulp flows. It is 12 ft. long and 3 ft. in diameter, and lined with corrugated rubber. A stationary launder, passing through the cylinder, serves as a collector for the concentrate, which is washed off the rubber by water sprays at the top of the arc. The power required is almost negligible. A water spray on the rising side permits adjustment of the grade of the concentrate as desired.

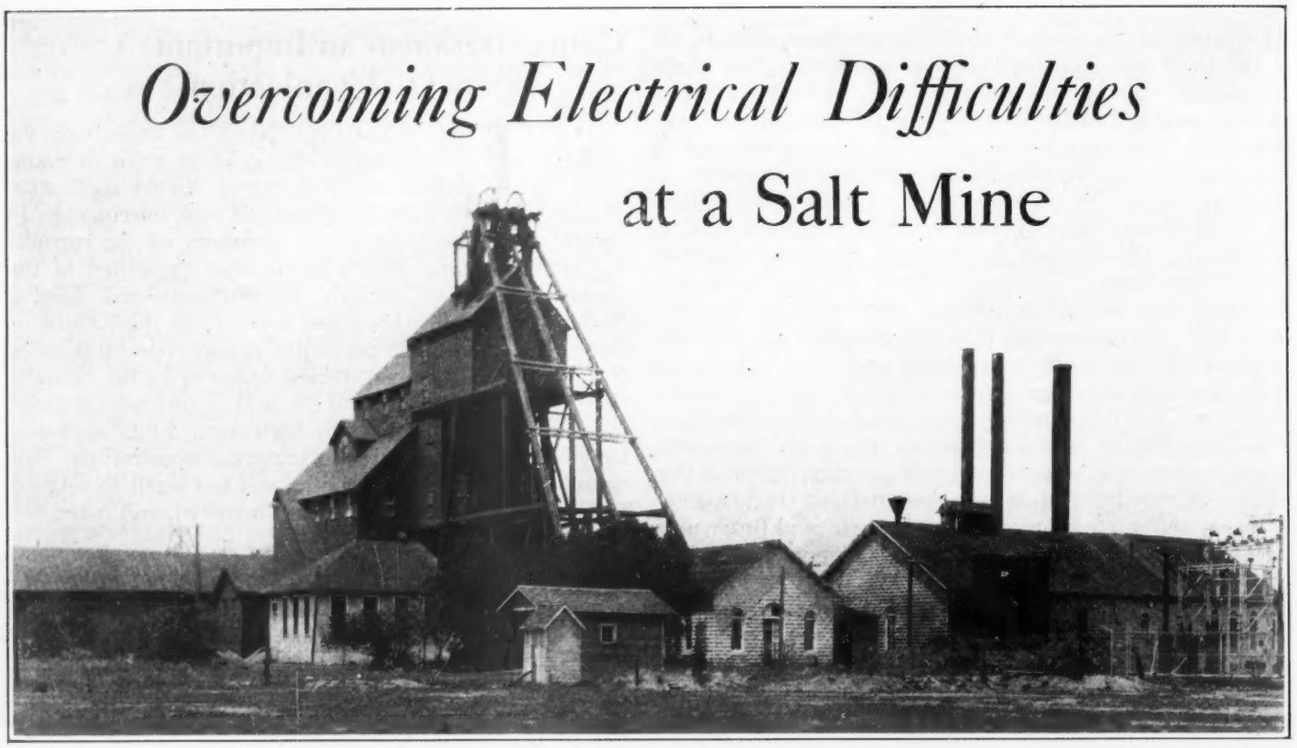
At the Cason mill of the East Rand Proprietary Mines the pulp from the stamp mill goes to classifying cones, the underflow from which is delivered, via tube mills, to ten of the new concentrators, each with a capacity of about 240 tons per day. The concentrate flows to an amalgamating and regrinding plant, the tailing from which joins the tailing from the concentrators, any oversize present being trapped in classifiers and returned to the primary tube mills.

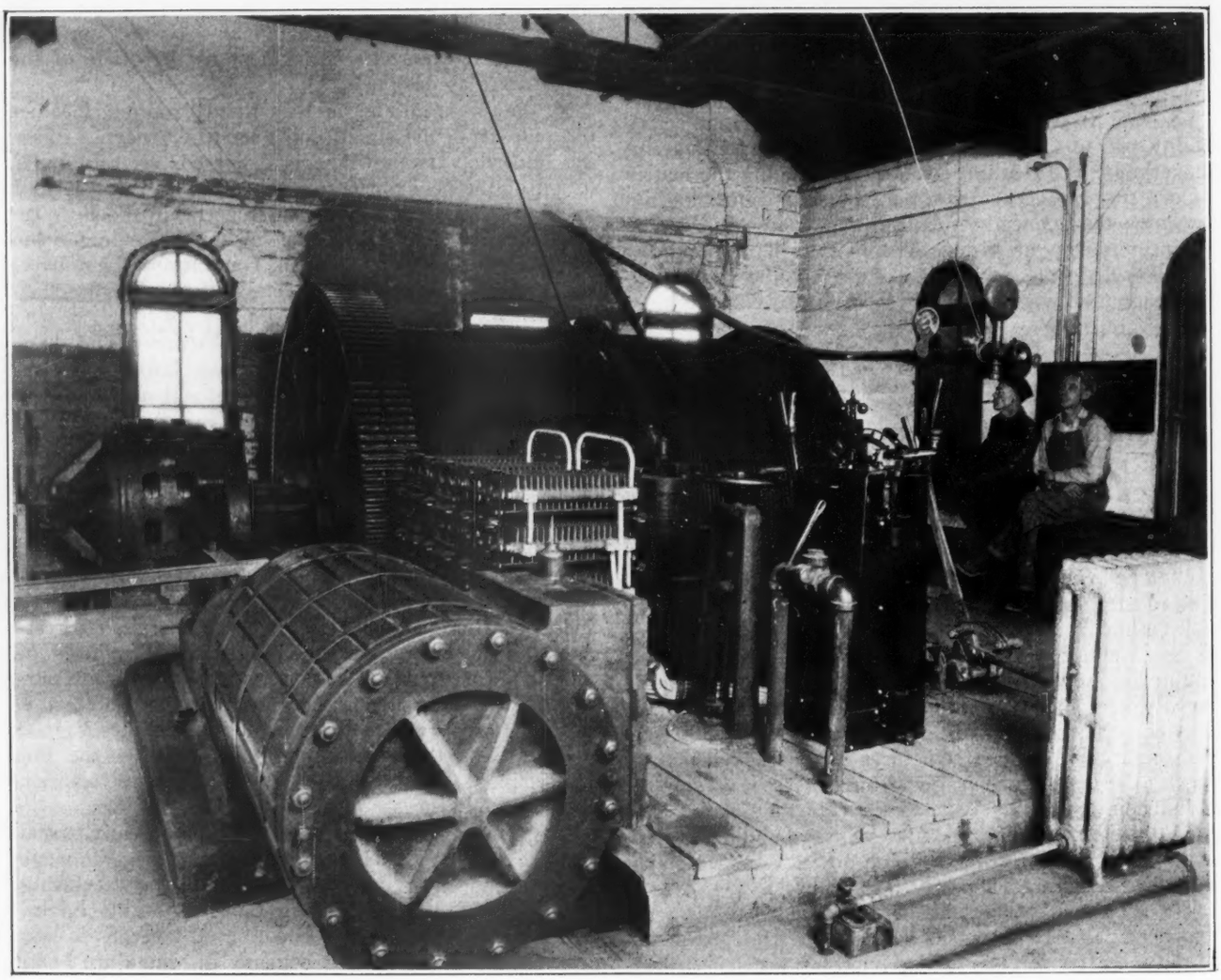
Two other companies on the Witwatersrand have adopted the principle outlined—Crown Mines and Consolidated Main Reef Mines & Estate, and plants at each of these properties were recently put in operation. West Rand Consolidated has erected eight of the concentrators as roughers prior to concentration on James tables, used to extract pyrite from sand. The product, containing 96 per cent iron disulphide and representing a recovery of 80 per cent of the pyrite in the sand, is being sold to a local dynamite factory for the manufacture of sulphuric acid.

It is difficult to overestimate the value, where practicable, of a concentration of an ore preliminary to its treatment by wet chemical methods. In the metallurgy of gold this concentration may serve two important purposes: it obviates the fine grinding of material that is too poor to justify such expense; and it simplifies a phase of operations that is fundamentally sound — the impoverishment of the pulp before intensive solution methods are begun.

The problems involved are usually more mechanical than technical. Mr. Johnson's work on large-tonnage concentration apparatus is timely, and the increasing application of the cylinder machine in South Africa should receive the serious attention of executives and metallurgists in the Americas, many of whom are looking for fresh inspiration as to possible methods of attacking the problem of treating low-grade ore.

Overcoming Electrical Difficulties at a Salt Mine





Surface plant and hoist house of Crystal Salt Company, Kanopolis, Kan.

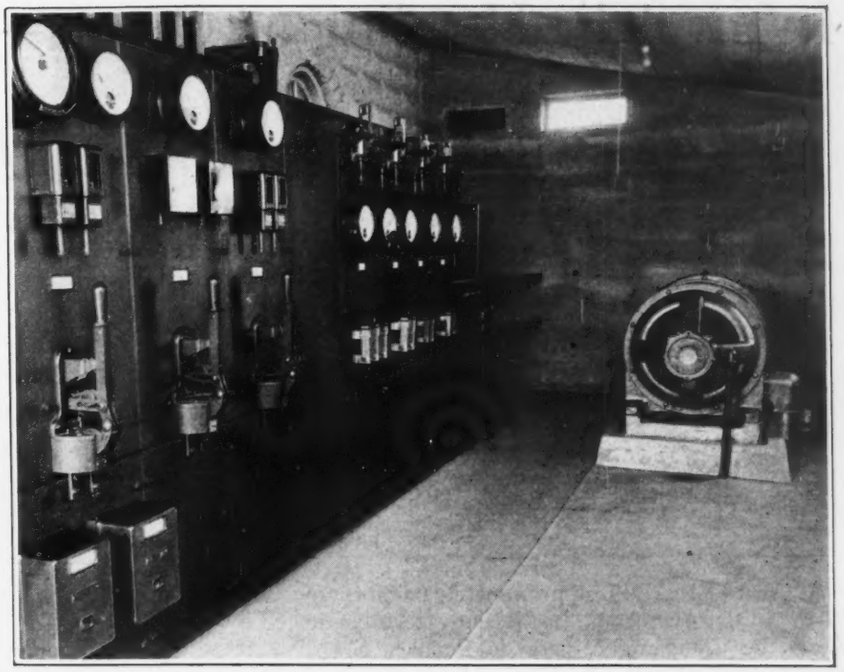
As

Described

By

L. M. Stauffer

General Electric Company
Denver, Colo.



Switch house of Crystal Salt Company, showing the a.c. or d.c. feeder panels and the synchronous motor-generator set

SALT is mined by the Crystal Salt Company at Kanopolis, Kan., from a flat vein approximately 10 ft. thick and 300 ft. below the surface. A roof of slate makes it possible to open large rooms and leave a minimum amount in pillars. The salt is undercut and shot down with black powder. It is then loaded in cars, hauled to the shaft by storage-battery locomotives, hoisted, and dumped into bins.

Two shafts give access to the workings. Hoisting is confined to the main shaft, the other supplying a means of escape in case of emergency. The latter shaft is downcast and the former upcast. Any moisture in the incoming air is apparently absorbed by the salt faces, so that the mine air is absolutely dry.

In the mill, where the salt is ground and sized, atmospheric conditions are just the reverse. Here it is almost impossible to prevent rapid corrosion of iron and steel parts. The wiring of lighting fixtures, motors, and other equipment was therefore done in accordance with the standards that are customarily prescribed for marine work.

Several months ago, after making a survey of the property, the management concluded that new power equipment was necessary. Up to that time the mine had been generating its own power by means of engine-driven direct-current generators. It was decided to abandon the old plant, which was inefficient, and to purchase power from the local utility company. It was also decided that the direct-current motors should be replaced in large part by squirrel-cage motors, thereby eliminating most of the work of maintaining the motors. The commutators of the direct-current motors were constantly giving trouble in the damp, salty atmosphere of the hoist house and mill.

To eliminate trouble from the same source in connection with the control devices, a novel scheme was adopted. This involved the use of three-phase, high-torque, high-reactance, squirrel-cage induction motors, with the leads run in cable and the starting boxes placed outdoors in an inclosed porch where they would have plenty of fresh air. A vapor-proof type of push button was provided at each motor and duplex cable was run to the starter outdoors.

Further, the management decided to electrify the old steam hoist. It was impracticable to replace all the direct-current equipment in the mine, so a synchronous motor-generator set was installed. This had the added advantage of giving the total load a very high power factor. The utility company offered a premium for power factor above 85 per cent, which made it possible to obtain a good power rate.

The synchronous motor-generator set is unique. It is started at full voltage, takes its excitation from the direct-current generator, and has no field switch or field rheostat. A fixed resistance set to draw full kilovolt input under normal conditions is provided. The motor-generator set is started by closing the main-line switch, comes to speed, and a direct-current voltage indication at once appears on the switchboard.

THE plant was changed over as described and was placed in operation during November, 1927. Most of the work was done while the plant was running, so that it was necessary to shut down for about three days only —this in order to electrify the steam hoist. To do this, the connecting rods of the steam engine were removed, a gear was bolted to the side of the hoist drum, and the motor was set in place. Hoisting was then resumed under electric power. The drive motor is rated at 150 hp. The ventilating shaft is equipped with a small electric hoist.

At the plant the average power factor is now 100 per cent and the maximum bonus obtainable from the power company is thus realized. The savings from the change-over will be sufficient to pay for the new equipment in a few years.

In an Adit Heading at Ojuela—

Averaging 714 Feet Per Month

For 5,000 Feet

By JOHN W. BEARD, *formerly mine superintendent;* S. A. MEWHIRTER, *formerly assistant mine superintendent; and* G. W. HEZZELWOOD, *assistant mine superintendent, Compañia Minera de Peñoles, Ojuela Unit, Durango, Mexico.*

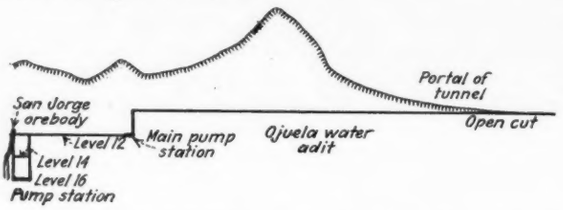
A WATER ADIT, approximately 6,000 ft. long, with an 8x9-ft. section, has recently been completed by the Compañia Minera de Peñoles, S. A., at its Ojuela unit, Ojuela, Durango, Mexico. The Peñoles company is the Mexican subsidiary of the American Metal Co., Ltd., of New York. F. S. Norcross, assistant general manager for the Peñoles company, had supervision of the work and directs the organization. The accomplishment has, we believe, set a new record for average monthly footage made in tunnel work, using the word "tunnel" as a broad term for this kind of driving.

An average of 714 ft. per month was maintained throughout the required seven full months of machine drilling in one tunnel face. Apart from the footage mentioned, 613 ft. of open cut and about 363 ft. of tunnel were excavated by hand, before the installation of compressed-air equipment.

With the exception of a little timber used at and near the portal of the adit, the ground required no support. The adit was carried at a grade of 0.3 per cent without a ditch.

The best speeds recorded were as follows: Best monthly advance, 1,001 ft.; best advance made in 30 consecutive days, 1,017 ft.; highest advance made in two consecutive days was 80.4 ft., or an average of 40.2 ft. per day.

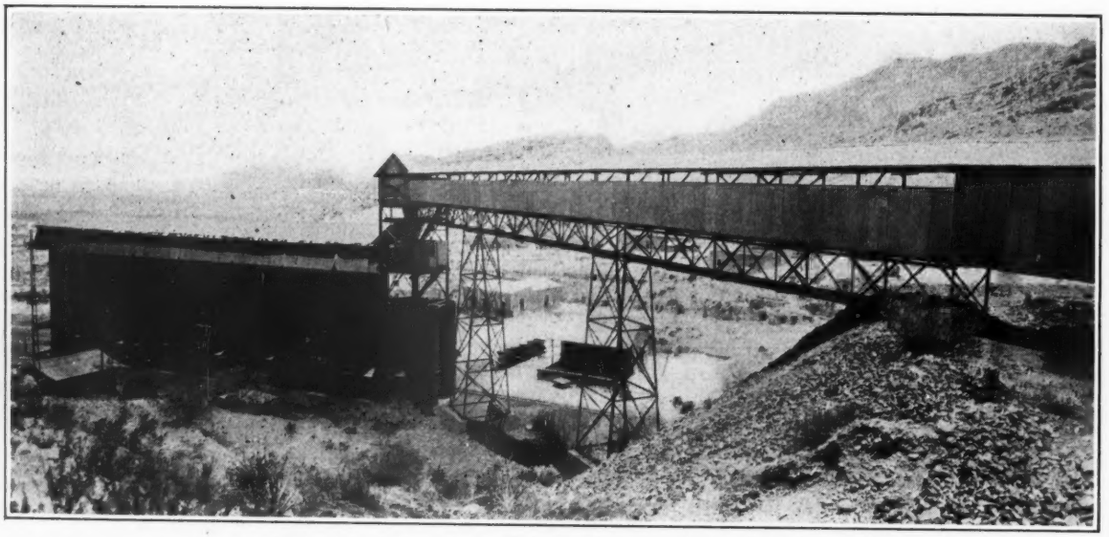
Fast work in tunnel driving is usually associated with expert contractors, who work either with a seasoned crew, or draft the best men obtainable. The record made at Ojuela shows that with good equipment, good organization, and experienced direction, an adit of this size may be driven at record speed without the necessity of contracting the work.



Profile of mountain showing 6,000-ft. adit

With the exception of the employment of an experienced foreman and three shovel runners, the labor was obtained locally. The properties of the Ojuela unit are situated on or near a prominent mountain of limestone called "The Bufa," made up chiefly of a thick series of limestones, with two minor beds of shale. These

Loading bins and railroad terminal for America No. 2 shaft



sedimentary rocks have been uplifted in the general form of a dome, from the center of which the strata dip away, into the plain. Subsequent to the uplift, folding and faulting have greatly modified the structure.

At the beginning of 1927, a careful estimate was made of probable ore, the probable life of the mine, and the amount of water to be pumped. The driving of a drainage tunnel was justified.

The water level is a few meters below the twelfth level. All water is being handled from the lower levels to the twelfth, by one or more stages of pumping, and is pumped from this level to the surface. The average volume of water being pumped under normal conditions is about 8,500 g.p.m. Formerly, pumping from the twelfth level to the surface was accomplished by means of two installations, known as the Tiro Norte and the America No. 2 pumping plants. A new adit pumping plant will be equipped with highly efficient centrifugal pumps, having a combined capacity of about 10,200 g.p.m. against a head of 340 ft.—slightly more than the lift under the new arrangement.

The following tabulation shows the saving to be expected from the new station and adit, as compared with the old. Calculations are based on the pumping of the entire flow of water to the surface and on a cost of $85 per kilowatt-year for steam power:

Total to be Pumped, G.P.M.	Kw., Including Lines Losses		—Saving Expected—	
	Old Station	New Station	K.W.	Dollars per Year
8,500	1,990	915	1,075	$91,375
9,700	2,185	1,075	1,110	94,350
12,500	2,795	1,390	1,405	119,425

Tunnel Survey

Preliminary surveys demonstrated that a level adit, 6,018 ft. in length, would reach from the point selected at the surface to a point about 315 ft. above the nearest mining workings of the twelfth level. A new raise, 328 ft. high, was driven to connect the working with the new adit and accommodate the pump column.

Two separate survey parties determined the alignment, each using a different method, as far as possible. Accordingly, one survey was made entirely by a transit and tape traverse; the other party executed the surface work by the triangulation method, traversing the underground portion.

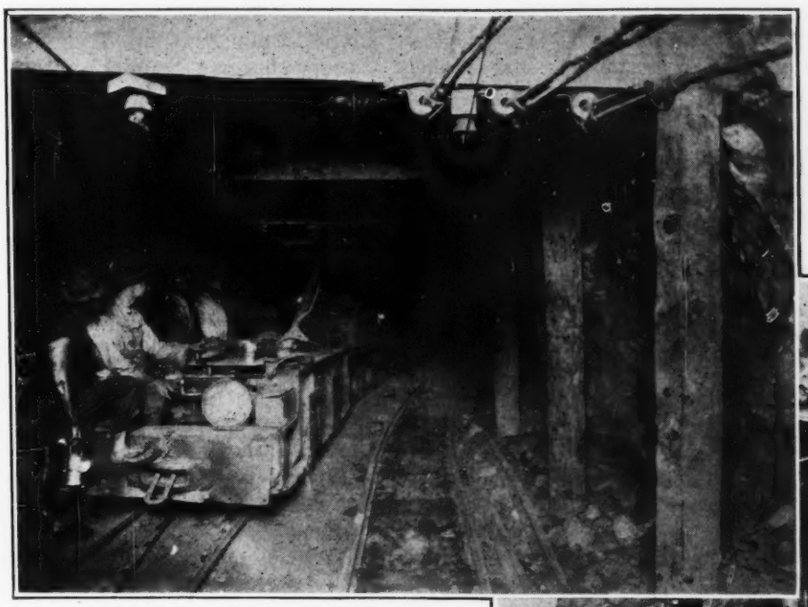
The only unusual part of the work was the tie between the surface and underground portions. This was made by hanging one wire in each of two shafts, about 3,050 ft. apart. Each party carried out the plumbing, measuring and traversing between the wires separately. On the surface, one party tied in by traverse, and the other by triangulation.

On account of the importance of the grade line, the leveling was given particular care. The total length of combined surface and underground traverses was about 18,564 ft.

The maximum difference of elevation between the highest and lowest points of the survey was about 1,279 ft., this being the difference in elevation between the twelfth level of the mine and the summit of the highest ridge crossed.

When the adit holed through the alignment was found to be out 0.8 ft. and the elevation 0.25 ft. Credit for this good work is due to R. G. Bloomer, A. L. Ferris, R. Rhew, Henry Holcombe, and Francisco L. G. Quintanilla.

Because of the distance of the adit mouth from the mine, it was necessary to build a camp to house the workmen and equipment. All of the equipment was purchased, with the points here listed in view:



Left — Electric haulage with trolley locomotives, one of which appears, cuts underground costs at Ojuela

Right—Ore is raised through an "internal" shaft by an electric underground hoist, shown at the left

1. Availability for immediate shipment.
2. High salvage value.
3. Suitability for transfer to other operations after the completion of the tunnel.

As the saving to be effected by the completion of the adit made speed of primary importance and cost secondary, the use of mechanical equipment for every operation was essential and a drill carriage and a mechanical shovel were therefore made features of the equipment.

Electric power was supplied by the construction of an 8-mile transmission line of No. 6 wire on wooden poles, from the 6,600-volt, 3-phase mine line. Two 200-kva. transformers with lightning arresters and switches were borrowed from the mine, to step the current down to 440 volts for the compressor, blower, and lighting systems. A 12-mile wagon road was cleared across the plain to the Mapimi-Bermejillo road.

Machinery included the following:

Shop Equipment — Drill-press, anvil, emery wheel, line shaft, motor, sharpener, forge, supplies.
Compressor, I. R., 21 by 12½ by 14-in., PRE-2; direct connected to 440-volt Unity P. F., synchronous motor.
Vano (S. P.-350) air-driven exhausters for 16 in. pipe (2)
No. 7 Connersville blower and motor.
Butler mechanical shovels (2)
Double side-dump roller-bearing cars, 40-cu.ft. capacity (12)
Ford truck, 1 ton.
Columns, arms, and clamps for drill carriage.
Drills, Hose, and Accessories—
N-72 Drifters (8)
R-72 Drifters (1)
T-3 Drifters (2)
Track and Track Material—1,100 20-lb. rails with steel ties, bolts, fish plates, and turnouts.
Pipe—
1-in. black standard—water line (5,325 ft.)
2-in. black standard—water supply (9,960 ft.)
3-in. black standard—air line (1,017 ft.)
4-in. black standard—air line (5,782 ft.)
16-in. galvanized ventilating pipe, 16-gage, compression band joints (4,575 ft.)
Wire—27,000 ft. No. 6 hard-drawn copper wire for power transmission line.
Locomotive—Titan B, storage-battery locomotive with two batteries, charging set, and switchboard.
Original supplies ordered—1¼ in. hollow round drill-steel Sandvik special (3 tons).
1¼x8 in.—40 per cent dynamite (1,115 cases).
No. 8 caps (25,000)
Fuse (175,000 ft.).
Drill repair parts.

The drill carriage was made in the mine shops, using standard materials as far as possible. The truck is a 40-cu.ft. car truck; all clamps, arms, and columns are standard. Universal clamps and pipe were used for the upright arms to give greater flexibility than standard arms.

A drill-steel carriage designed by George W. Hezzelwood was attached behind to carry steel, spare machines, and tools. On this was also mounted a floodlight as well as a blower to drive back the fog from the air drills. A special portable switch, also designed by Mr. Hezzelwood, was used.

Excellent power conditions and good voltage control insured steady operation, free from minor difficulties. The connected load at the tunnel plant was as follows: Compressor, 210-hp. synchronous motor; blower, 110-hp. oversized induction motor; shops, 10-hp. induction motor; and Mancha battery-charging motor-generator set, 4-kw. induction motor.

Most of the equipment installed was larger than necessary, on account of the anticipated transfer to the Ojuela mine, after the adit was completed.

The tunnel driving organization was headed by:

George W. Hezzelwood, tunnel foreman,
R. G. Bloomer, tunnel engineer,
George Sundeen, shift boss,
George Baker, shift boss,
Earl Cooper, shift boss,
O. C. Rheinheimer, special night-shift boss.

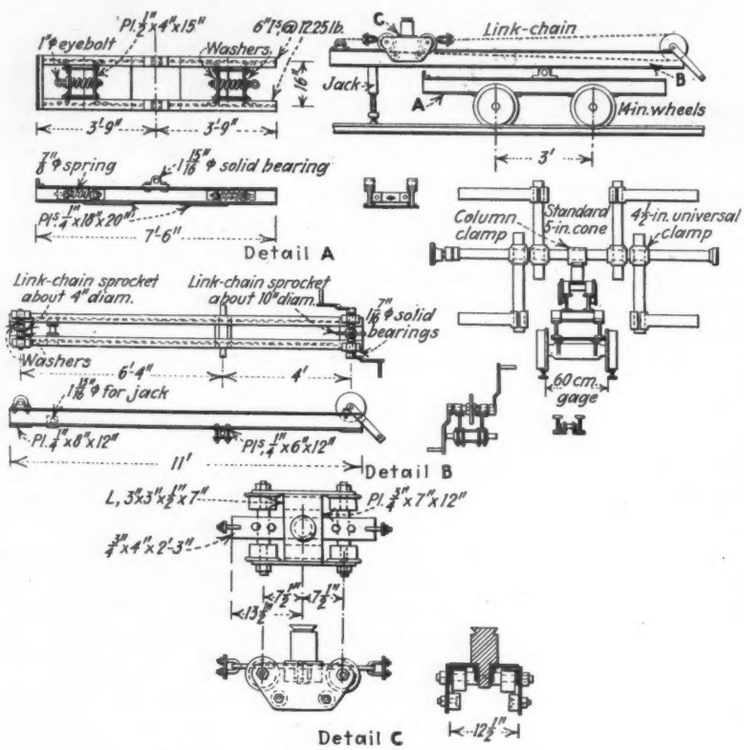
Two of the three tunnel shift bosses acted as shovel runners during the "mucking" cycles of their shift, and one was responsible for most of the shovel-repair work. The usual surface organization was maintained, with steel sharpening and repair shops, supply room, compressor, and ventilating equipment. All work was carried on continuously, each shift relieving its predecessor at the face. The regular driving crew consisted of one shift boss, one drill-carriage boss, four machine men, four chuck tenders, one trackman, four track helpers, one motorman, and one motor helper.

Four drills, mounted on a drill carriage, were used at the face. It was found advisable to carry one extra machine man and one helper on each shift, to obviate any possible shortage of drill operators. These extra men also acted as tool nippers during the drilling cycle. The crews worked eight hours straight, performing both the drilling and mucking operations, as shown on the schedule of work given herewith.

The "day's pay plus bonus" system was a departure from the usual contract form of handling mine labor in Mexico. This system necessitated closer supervision and direction of the work on the part of the company than would be needed in contract work. The shift bosses spent the entire time at the face, and, in conjunction with the drill carriage boss, pointed the holes, directed the loading and firing, and prevented duplication of effort, as far as possible.

Ventilation was effected by a No. 7 Connersville positive blower, exhausting continuously through a 16-in. galvanized-iron pipe. The work of maintaining and extending the ventilating pipe was done by a crew of four men, who worked day shift only.

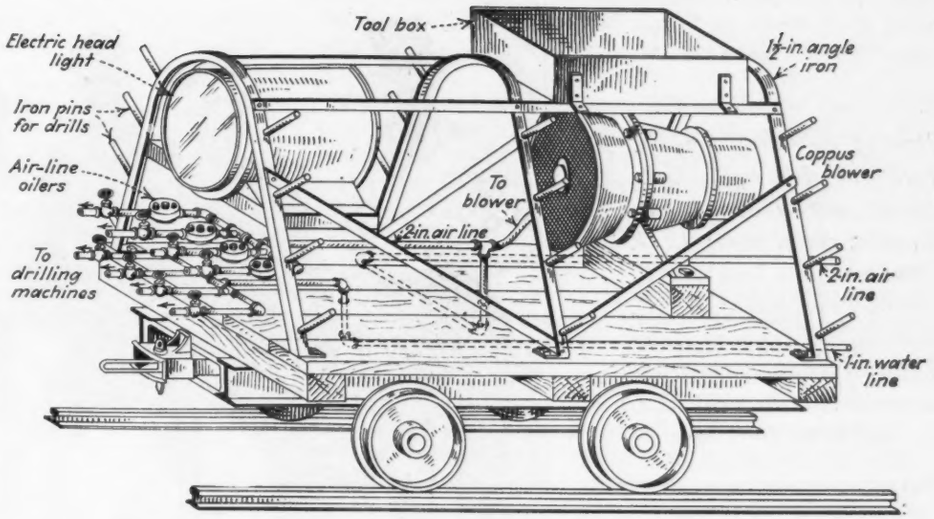
The blower was equipped with connections for reversing the direction of the air current, and the best results were obtained by operating it as an exhauster. Smoke from blasting



Details of Ojuela tunnel drill carriage

was removed very rapidly, and little time was lost by waiting for the heading to clear.

The question of removing the fog made by the four machines, at the face, during the drilling cycle, presented quite a problem. It was noted that blowing, or reversing the direction of the air, made the condition at the face worse, and visibility became poor farther back from the face. After some experimenting, an air-driven auxiliary fan was mounted on the steel carriage. By exhausting from the face through a 16-in. flexible tube directly in front of the end of the 16-in. permanent vent pipe, improvement was secured. A further improvement was secured by mounting a floodlight on the steel carriage, equipped with a parabolic reflector and a 250-watt bulb. The light shone directly into the face while drilling was in progress, and the visibility was greatly improved.



Sketch of Hezzelwood rock-drill tender developed at Ojuela

Schedule of Operations

The standard schedule of operations, beginning with a clean set-up, was about as follows:

The shovel was pulled back to the passing switch, indicated in the accompanying sketch, and the drill carriage pushed up to the face, where the bar was jacked into the side and drilling was started. Each machine had a prescribed number of holes to drill, during which time the shovel runner overhauled and oiled the shovel and the track crew cleaned up along the side to prepare for track and pipe.

After the drilling was completed, the electric motor pulled the drill carriage back to the portable turnout switch, and the drilling crew blew, loaded, and blasted the round. The crew waited at a point about 1,000 ft. back from the face until the last lifter exploded, after which they walked up to the smoke, usually waiting at that point for about ten minutes, when all hands took shovels and cleaned up the track, to the point at which the "muck" was about a foot high. In the meantime the electric motor was coupled to the shovel, on the passing switch. The shovel followed the crew, and necessary connections were made when the muck pile was reached. The cleaning operation usually took another ten minutes, before shoveling began.

Three men pushed a 40-cu.ft. car from a group of six empties from the portable turnout switch to the shovel, after which another empty was placed on the passing switch to be exchanged as soon as the first was filled. Loaded cars were returned to the loaded side of the portable turnout switch and taken outside by the haulage motor as soon as a train was completed. Empties were kept on the opposite side of the portable turnout switch.

Considerable time was saved by frequent moves of the passing switch, for the purpose of keeping it within 150 ft. of the face, and when the distance between the portable and passing switch became so great that an empty could not be returned to the passing switch while the mechanical shovel was filling a car, the portable turnout switch was moved ahead.

When the shovel had cleaned up to a point beyond the end of the rail placed during the previous mucking cycle, short sections of rail were laid, until there was enough space to lay a standard section, whereupon the short lengths were replaced.

While loading was in progress, one of the machine men and the drill-carriage boss inspected the drills on the carriage, replaced dull steel with sharp steel, filled the oilers, and made everything ready for drilling the following round. The air and water pipes were laid during the time needed for setting up the carriage. All heavy switching of empties and loaded cars on the portable switch was made with the electric motor, to save the men as much as possible from the heaviest work.

Shift bosses turned in daily reports showing the schedule of the operations, from which the accompanying time studies were made.

Table I—Distribution of Time in Total Cycle

		Average Cycle Hours	Average Cycle Minutes	Best Cycle Hours	Best Cycle Minutes
Setting up	Delivery of drill carriage to the face and setting up	0	30	0	15
Drilling	From time of first drill starting until last drill had finished	1	50	0	55
Blasting	Tearing down, blowing, loading and blasting	0	35	0	25
Waiting for smoke		0	12	0	5
Cleaning up for shovel		0	15	0	7
Loading (average of twenty 40-cu.ft. cars per round)		2	00	1	45
Interval between (loading completed and set-up started)		0	15	0	7
		5	37	3	37

An attempt was made to standardize the drill round, but the ground was found to be so variable that considerable latitude was allowed the shift bosses. A round having a double pyramid cut was used generally, consisting of from 22 to 28 holes. Studies of the drill rounds in use were made by means of a model, fabricated of chicken wire suitably supported, about the size of the drift. Poles of appropriate size were placed in the model to represent the drill holes in the round, which were varied as the number and position of holes were changed.

Owing to the anticipated saving in pumping, of approximately $300 per day, high overhead, and other factors, speed in driving was particularly essential, and it was recognized, at the beginning of the job, that a special inducement or bonus would be necessary. A base rate of pay was decided upon, which was slightly higher than the rate applying in the district; in addition to

Part of the tunnel "crew": back row, left to right—G. L. Baker, shift boss; E. M. Cooper, shovel boss; L. G. Sundeen, shift boss; R. G. Bloomer, engineer; G. W. Hezzelwood, foreman; John Ziotti, drill boss; sitting, left to right—Carlin, drill boss, and Etzel, shift boss

which a bonus schedule was worked out to begin at footages over 600 ft. per month, as follows:

Monthly Advance, Ft.	Per Foot, Pesos	Total for Maximum, Pesos	Total to Be Distributed, Pesos
600–650	6	300	300
650–700	7	350	650
700–750	9	450	1,100
750–800	11	550	1,650
800–850	14	700	2,350
850–900	18	900	3,250

The total amount of prize was divided among the men working in the face in proportion to their base rate of pay. The bonus was payable each fifteen days. This system failed to get the desired result, because of the fact that the average Mexican workman is not spurred to an extra effort by a reward payable too far in the future—it must be forthcoming at once, preferably daily, to get the best results. The bonus system also had the fault, common to most bonus systems, that it did not recognize the difference in ability between men. It paid a good man exactly the same bonus as an inferior one. This arrangement did not give a particular incentive to the good man, but rather had the effect of holding the pace to that of the inferior man. To counteract these shortcomings, a prize system was established, as follows: The machine man and helper of the two top machines who finished their portion of the round first received one peso each when they came off shift. The same applied to the two bottom machines, thus setting up a competition among the men and giving the good man a chance to profit by his speed. Another prize, of an extra day's pay per week, was paid to each man on that shift accomplishing the greatest number of units of work during the week, which resulted in keen competition between shifts. These units of work, based on the average time of a complete cycle, during the two-week period preceding, were calculated daily and published on the bulletin board, so that each shift could see its daily standing at a glance. This system of competition secured the desired result, inasmuch as the average advance increased approximately 38 per cent soon after it was established. The objectionable feature was that it required closer supervision on the part of the shift bosses, to prevent a shift from slighting a certain part of its work, so that it might gain over the other shifts. The following tables show various informative data, particularly those of the cost of the project.

Ground was broken for the open cut on March 1. The compressor started on June 1, after 363 ft. of tunnel had been driven by hand.

Table II—Monthly Advance in Adit

1927	Advance, Feet	Eight-Hour Shifts Worked	Average per Shift Feet
June	615.5	83	7.41
July	789.5	93	8.5
August	601.7	93	6.46
September	581.2	85	6.84
October	598.3	91	6.58
November	811.7	87	9.33
December	1,000.8	93	10.8
1928			
January	42.6	5	8.5
Total	5,041.3	630	7.95

Table III—Summary of the Principal Cost Items

	Pesos
1—Construction and roads	27,042
2—Equipment and installation	93,186
3—Open cut	8,607
4—Tunnel portal (timber)	3,999
5—Tunnel proper	226,993
Total cost	359,829
Estimated cost	351,000
Excess	8,829

Layout of tracks near heading, showing drill carriage, steel tender and switches

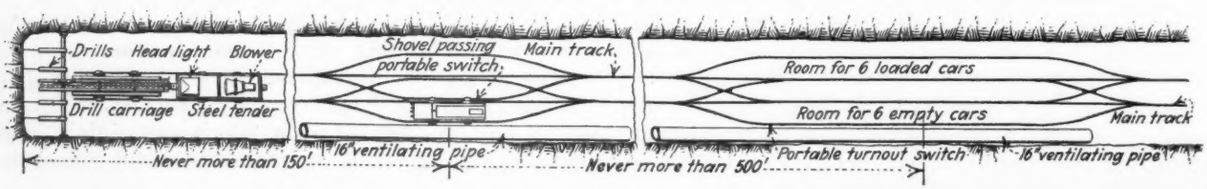


Table IV—Major Unit Costs

In pesos

	Per Foot		
	613 Ft. Open Cut	5,405 Ft. Tunnel	6,018 Ft. Tunnel and Open Cut	6,018 Ft. Tunnel and Open Cut, Salvage Value Credited[1]
1—Construction and roads		5.00	4.50	4.00
2—Equipment and installation		17.24	15.48	5.00
3—Open cut	14.04	1.59	1.43	1.43
4—Tunnel		42.73	38.38	35.02
Total U. S. currency		66.56	59.79	45.45
		28.62	25.71	19.54

[1] All equipment was transferred and sold to the company's major units. The last column therefore gives actual net unit cost of the project to the company.

Minor Unit Costs—No Salvage Credited

In pesos

		Per Foot	
		Tunnel, 5,405 Ft.	Tunnel and Open Cut, 26,018 Ft.
Construction and Equipment			
Open cut, average cross section—5x12	8,607	1.59	1.43
Buildings	26,511	4.90	4.40
Roads	531	.10	.09
Equipment and installation	93,186	17.24	15.48
Total	128,837	23.83	21.41
Operating Labor			
Underground—flat 41,928.94		*7.76	*6.97
Underground with bonus	57,264	10.59	9.51
Surface shops waste disposal	24,004	4.44	3.99
Supervision engineering office—flat 21,765.72		*4.03	*3.62
Supervision with bonus	30,416	5.63	5.05
Sub-total	111,685	20.66	18.56
Operating Supplies			
Explosives	40,741	7.54	6.77
Carbide	1,046	.19	.17
Drill steel	8,161	1.51	1.36
Power	16,435	3.04	2.73
Air drill (repairs)	7,267	1.34	1.21
Air, water, hose and connections	1,873	.35	.31
Track	8,761	1.62	1.45
Ventilating	12,326	2.28	2.04
Lighting	3,738	.69	.62
Air and water line	7,030	1.30	1.17
Butler shovel	1,992	.37	.33
Truck	2,607	.48	.43
Oils, grease	2,329	.43	.39
Shop and miscellaneous	2,349	.44	.40
Boarding house	2,644	.49	.44
Sub-total	119,396	22.07	19.82
Grand total	359,829	66.56	59.79

*Items not included in totals.

Price vs. Quality in Purchasing

CHARLES E. CARPENTER, in that most interesting of house organs, *The Houghton Line,* has the following to say as to the proper conduct of a purchasing department:

"In the progressive march from office boy to president of our concern, I stopped for some three years in the purchasing department. As purchasing agent for our concern I certainly took over a most demoralized department. It had more favorable purchasing contracts than it would be possible to imagine. In every instance it had been the aim of my predecessor to prevent anyone who sold to our company from making any profit. The attitude of the sellers proved the fact. Most of the clerical work of the department was devoted to making claims and settling disputes with the sellers. We, rather than the sellers, dictated the terms of every contract. And believe me, no other concern ever kidded itself into believing it was so exceptionally efficient in its purchasing as did we.

"But I had the advantage of my predecessor, inasmuch as I had had several years' experience in selling. I am certain that the best purchasing agents are those who have had the practical experience of selling, for then they have the experience of both viewpoints. I knew, as a seller, that those concerns who obtained the best of everything from our company were those upon whom we made a profit, and those who received the least of everything were those who had forced us down to a point where there was no particular advantage in their patronage.

"Why is it that wise men will admit that the way to obtain the best quality of executives and the best that is in such executives is by paying such executives a salary which is in proportion to their ability, and yet will tolerate a purchasing policy which will deny to the seller a profit that is commensurate with their ability to serve the buyer?

"So one of my very first acts was to encourage competition for our business among the reputable sellers, for I found that owing to the 'cheap' policy of our company, the best sellers were not only indifferent to our trade, but rarely solicited it. In other words, we were noted as being 'cheap buyers,' and we obtained all of the disadvantages as well as the advantages of such a reputation, but in my opinion the disadvantages greatly outweighed the advantages. I proceeded to inaugurate a policy by which no one-sided purchasing contracts were to be made. I declined positively to make any contract by which we took advantage of the decline and did not pay the premium of an advance. It did not take long for the new policy to be noised about, and in a short time our trade was competed for by those who previously would not even answer a request for a quotation. I placed our purchasing department on a basis by which the seller was encouraged rather than discouraged; by which the seller was most interested in preserving our patronage rather than indifferent; by which quality rather than mere price was the standard of trade, and I flatter myself that our purchasing department has been conducted on that basis ever since.

"Inasmuch as the efficiency of the purchasing department is a most important factor in the success of any business, I can only point to the success of our business as evidence that the purchasing policy of our company, as inaugurated by myself, was a wise one.

"The buyer who fools himself into believing that he can deprive the seller of all profit, to his own advantage, is to be pitied rather than copied. The wise buyer of today knows that quality rather than price is the basis of economic buying. And you cannot obtain quality from price sellers. The two do not mix."

An American Tin Mine?

AMONG the few things of which the United States cannot boast in the mining world is a producing tin mine of consequence. Tin has been produced from one locality in South Dakota and from one in California, the latter being credited with about 100 tons of pig tin in 1892. The American Tin Corporation is engaged in an effort to develop sufficient ore in the California deposit to warrant the equipment of the property to resume production. Mr. H. E. West, a mining engineer from Santa Barbara, Calif., will describe the deposit and the recent work in an early issue.

Who's Who in the Mining Industry

FERNANDO BENÍTEZ Y GONZÁLES

THE subject of this biographical note was born in Teneriffe, Spain, in 1892, where he received a primary and secondary education. In 1910 he entered the Royal School of Mines, London, from which he graduated as an Associate in 1914. To gain experience, he then worked as a miner and a timberman in the Cornish tin mines and in the coal fields of Scotland. During 1916 and 1917 he held the post of demonstrator in the mining division of the Royal School of Mines, and for a time he was in charge of the classes in mine surveying provided by the school for candidates for commissions in the Tunneling Companies of the Royal Engineers. In 1917 he resigned to become research chemist to Hemingway & Company, of London, in connection with the development of a process for the recovery of tin from waste tin plate by electrolytic methods.

In April, 1918, Mr. Benítez went to Chile to become mill superintendent for the Catemu Copper Company—the first in Chile, after Braden, to adopt flotation. The problem was complicated; two plants handled the ore from five different mines. The result of three years' work in the elaboration of a technique and the control of recovery methods in the treatment of complex ores of wide variety was published in two articles that appeared in 1921 in *Mining and Scientific Press*. After the expiration of his contract with the Catemu company Mr. Benítez acted for several clients in a consulting capacity, and during 1922-23 he was manager for the Lomas Bayas & Chañarcillo Company, formed to explore the famous and ancient workings in the districts of the same names. Owing to ill health, however, he was obliged to curtail professional work; but, being constitutionally averse to inaction, he joined the staff of the Sociedad Nacional de Mineria as editor of its *Boletin Minero*, bringing to that publication a breadth of survey and an evidence of technical alertness that greatly enhanced its popularity and usefulness. In May, 1926, Mr. Benítez was appointed manager for the Compañia Minera del Huasco, formed to explore the famous Vizcachas silver mine, in Atacama. In June, 1927, he undertook a metallurgical research on the ores of the Compañia Minera Disputada de las Condes, with a view to the introduction of flotation conditioning reagents in the company's mill, in the hope of increasing recovery, which was then unsatisfactory. His work, when translated into commercial operation, proved so successful that he was offered and accepted the post of mill manager; and in March, 1928, he was made manager. In addition to executive duties, he recently constructed an extension to the plant, which is now in operation. His professional success may be traced in part to sound training and to an inquisitiveness that has made him conversant with mining and metallurgical technique and progress through the world.

Mr. Benítez is a keen reader of the technical journals; and, with a commendable realization of obligation to his fellows in the profession, he has contributed several articles on mining, geology and metallurgy to the *Mining and Scientific Press, Engineering and Mining Journal, Mining Magazine,* and *El Boletin Minero.*

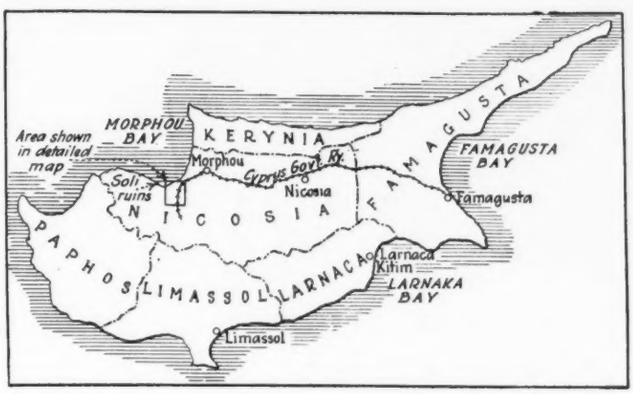
The Cyprus Mines Enterprise—II

A Historic Property Enters the Ranks of Copper Producers

By V. G. HILLS

Cyprus Mines Corporation
Skouriotissa, Nicosia, Cyprus

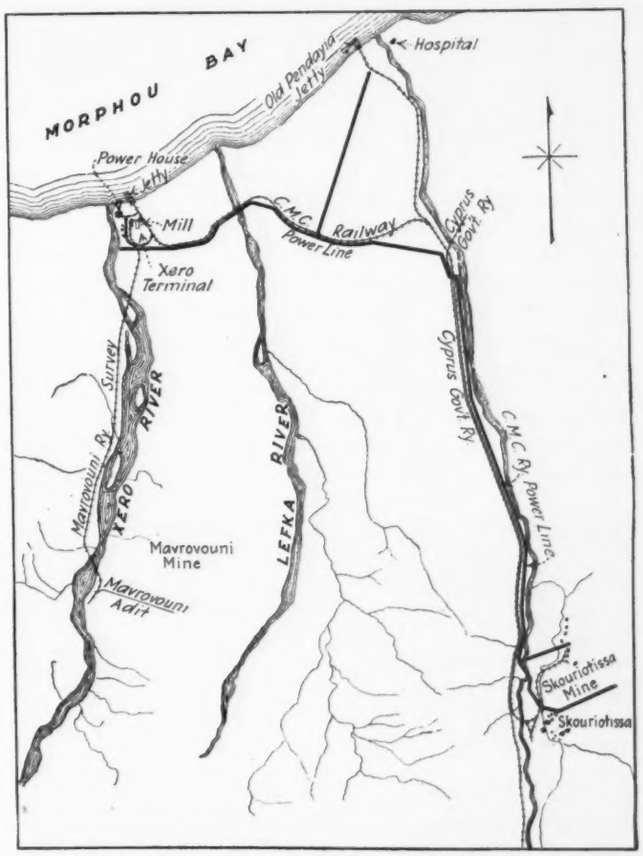
THE Skouriotissa ore deposit is a lenticular mass of cupriferous pyrite lying nearly horizontal, 1,850 ft. long, 800 ft. wide, with a maximum thickness of 140 ft. It has been developed by 45 drill holes and 30 shafts and adits. The contact marking the capping of the ore outcrops on all sides of the containing hill, and this particular body is now fairly well delimited.



Outline map of Cyprus

The ore is a replacement of the "pillow-lava" andesite. Above the ore, with an even abrupt contact, lies a thick blanket of umber, then marls, and, above the marls, limestone. The bottom of the ore forms a ragged contact with the andesite. Professors C. G. Cullis and A. B. Edge, in a report on the cupriferous deposits of Cyprus published by the Crown Agents for the Colonies, London, 1922, speak of the marls as influential in hindering the escape of the ore-bearing solutions. At Mavrovouni there is 200 to 400 ft. of the andesite, with only disseminated pyrite between the ore and the marls; and hence this deposit seems to be independent of the sedimentaries. However, a continuation up to the contact may yet be found. Cullis and Edge credit the origin of the ore to diabase intrusions (found throughout the island), penetrating the older andesite, or to still later formations below and junior to the diabase.

Dr. Spurr might make a fine case of magmatic segregation out of these Cyprus deposits. Although I have expressed my skepticism in regard to this theory as applicable to most ore deposits (*Mining and Metallurgy*, Vol. VIII, p. 189), I should say that these Cyprus deposits are better suited to that view than some of the cases cited by Dr. Spurr. The Skouriotissa deposit seems to favor this theory, but at Mavrovouni immense zones of disseminated pyrite range all the way between 20 and 90 per cent pyrite, above and below the pay zone. This would seem to indicate replacement origin; and all the conditions, geological and mineralogical taken together, at these places, and perhaps generally over the island, seem to call for the same theory. Cullis and Edge, who have recently been here for a second examination, are emphatic in calling all these Cyprus ores replacements. They mention kernels of acid-bleached lava in the ore as evidence of replacement; but this would fit the magmatic theory just as well. They go so far as to refer to the ore as showing, in places, the rolling pillow-form



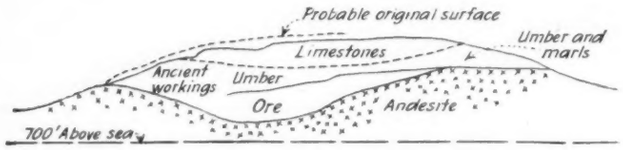
General surface plan of the mines, ports, and railways

of the original lava. My observations have not confirmed this.

Mine water discharging from the 710 adit—a small flow—partly natural and partly from drill water, runs through launders filled with scrap iron. The cement pre-

cipitate accumulated amounts to about 2,000 lb. of 65 per cent copper per month, and the cost is negligible.

Skouriotissa ore, remarkably clean and uniform as to content, is mined and shipped without sorting. The pyrite is of exceptionally good burning quality, and this, with its high-sulphur and low-arsenic content, makes a product attractive to many chemical works. It is sold for copper and sulphur content only, though the iron is doubtless a consideration with purchasers. The sulphur



Cross-section showing mineralization of the Skouriotissa orebody

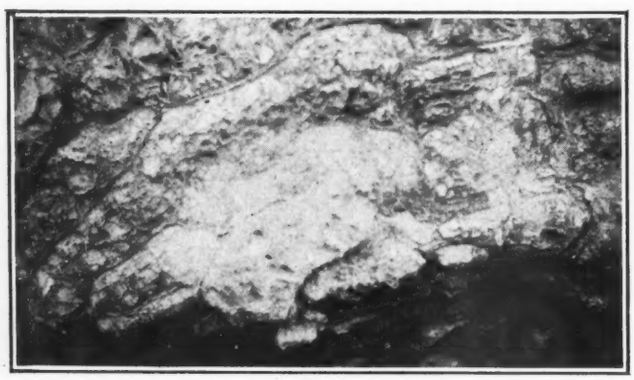
is now responsible for more than half the financial return.

Generally speaking, the ore is a cupriferous pyrite. Covellite, chalcanthite, melanterite, native copper, and native sulphur are occasionally found in small pockets, with probably many other copper and iron sulphides and sulphates. The following is a typical analysis:

Analysis of Cyprus Ore

	Per Cent
Copper	2.1
Sulphur	48.5
Alumina	1.25
Silica	1.75
Lime	Trace
Magnesium	Trace
Arsenic	0.01
	Oz. Per Ton
Silver	0.4
Gold	0.01

At one place was a layer of native sulphur, from one to two feet thick. It was 87 per cent pure and carried 0.33 oz. gold and 2.0 oz. silver. "Devil Mud" is a name given by the miners to streaks of a soft, crumbly material found in places at the bottom of the orebody. About 30 per cent consists of soluble salts of iron and copper, the remainder being fine slime. The name came from the peculiar property it has of passing into liquid slime when pressed between the fingers. Samples of this material have yielded from 2 to 5 oz. gold and 13 to 20 oz. silver. The ancients, in several places, worked on top of the present pyrite body, and probably they extracted oxidized



A specimen of "pillow lava"

ores from the entire top area, the concentration of gold and silver there contributing to the known ancient output of these metals from Cyprus. So completely and smoothly have the flexible umber and marls above the ore closed the old workings, that neither extent nor thickness can be determined.

The ancients also explored to the bottom of the pyrite body. With the limited knowledge of conditions as disclosed I should say that a fault of no great displacement formed a channel for the circulation of meteoric water, which in turn produced an oxidized zone. I do not know if this idea has been advanced before. The old workings are cave-filled so tightly that drifts through them require sometimes more powder for breaking than does the surrounding rock in place. The open passageways found are entrance-ways made in the country rock outside the ore formation.

By the railway it is 6¼ miles to the power plant, the mill, and ore storage sheds, the hospital, and jetty at Morphou Bay. The railway cars, double-hopper rocker-dump 15-ton, dump into a pre-mill storage with conveyor belts beneath leading to the crushing and screening buildings. Thence conveyor belts transfer to the post-mill storage sheds. Locomotives made from Fordson tractors take the ore in hopper side-dump cars to the jetty, where it is conveyed by chutes into barges. Company tugs take the barges to the freight ships anchored off shore. The fact that the sea is almost tideless and not often troubled with high winds makes this method of loading ships practicable.

A Mavrovouni churn-drill crew—all Turks except the boss

The railroad is of 30-in. gage, continued in the mine-haulage levels, throughout the mill yards, and on the jetty. Equipment comprises three Baldwin steam locomotives, four Fordson and one Vulcan gasoline railroad locomotives, twenty double-hopper 15-ton, and 35 single-hopper five-ton steel rocker-dump Kopple cars, and some service flat cars. The load is all down hill, and the train load is limited by the number of empty cars the locomotive can return to the mine.

It was found that different chemical works purchasing the ore preferred different sizes according to their several processes, and sizing was therefore advisable. The first plant was constructed from an old sawmill, operated by a portable steam boiler. This plant continued in operation until the opening of the present mill in March, 1927. Meanwhile a small mill was built at the mine. During this period the mill fines were mixed with natural fines and large lumps were separated by hand sorting, thus making three market products. This mill, never able to handle the entire mine output, was destroyed by fire in February, 1926.

By May, 1926, active construction was started on the present shore plant at the new jetty, opened on March

17, 1927. The mill is a crushing and screening plant with special features of design. Ore trains are carried over the pre-mill storage bin on a steel trestle. The girders support a concrete bed or pan beneath the railway tracks to hold the ballast and keep rain from the ore bin. This bin has specially designed hoppers with Stephens-Adamson traveling pan feeders delivering the ore to 36-in. cross belts, which deliver to the long conveyor belt leading to the crusher house. The belts are carried on idlers with automatic take-up Timken bearings. The long belt moves at 50 ft. per minute, to allow picking off scraps of waste wood and iron. Conveyor belts are all driven by electric motors with Jones speed-reducers.

a separate lease. Its ancient slag dumps are not so large as the Skouriotissa dumps, and are partly buried beneath the orange orchards. This is evidently the mine referred to by Galen as "thirty stadia distant from Soli."

Two American Star "A" Frame churn drills are exploring the orebody. The drill holes average 820 ft. in depth, the average thickness of ore being 120 ft. Much trouble arises from caving ground, particularly in the ore. The drills start at 12 in. and are reduced to 10, 8, 6, 4, and 3 in. successively as the casing becomes unmanageable with the larger size. When in ore, samples are taken at 5-ft. intervals. A record is kept of the geological formations and of the water as well as of the ore.

Phœnician slag dump in the foreground, behind which is the athletic field in a natural washfill. A portion of the Roman slag dump in the middle ground. The village of Kathadata is in the distance: with Mount Troodos, highest point on the island, on the skyline.

The entire plant, with its pre-mill and post-mill storage sheds, is of steel and concrete. Present capacity is 1,800 long tons per 24 hours. The construction plan is such that additional units can be added to mill and storage sheds without stopping the present ore-handling operations.

The power plant consists of three Springfield water-tube boilers, using induced or forced draft, with superheaters. Two Skinner engines are of 214 hp. each and one Nordberg engine is of 500 hp. All three are of the uniflow type and are direct-connected with Westinghouse

Transporting the ore from the mine to the shore

generators. This plant furnishes current for all power and lights for mine, shops, mill, offices, and dwellings. The current is generated at 460 volts, transformed for transmission to 11,500 volts, then down to 440 volts for the motors and 110 for the lights. On account of the scattered operations, five banks of single-phase transformers are used. Coal comes usually from England.

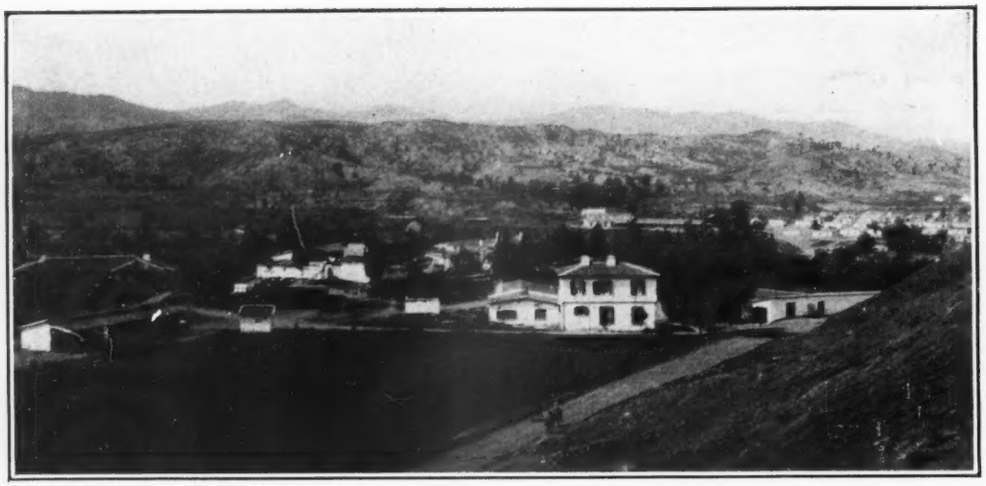
The Mavrovouni mine, 3 miles west of the Skouriotissa mine and 2½ miles from the mill and jetty, is held under

According to present disclosures, it appears likely that the ancients worked a wholly separate orebody, not connected with the deposit the drills are now sampling. No ancient workings have been found here. Geological situation and the shape of the orebody are similar to the Skouriotissa deposit. The character of the ore is geologically the same, but the copper average is higher and the sulphur content is lower.

The mine will be opened by an adit starting at the Xero Potomos (Dry River). This adit, the main shaft, and an intermediate shaft are now under way. The adit will be 2,200 ft. long to the drill-hole area, 316 ft. above sea level. At Mavrovouni, the ore lies partly above and partly below sea level. The main shaft will be outside the ore area in solid andesite. All ore will be taken from the adit, but the shaft will be maintained from the surface for hoisting and ventilation. A survey has been made to extend the railway from the mill yards to the portal of the adit.

The labor is 68 per cent Greek and 32 per cent Moslem. There are six Armenian refugees. This is about the same ratio as the island's population. Native women do a large portion of the outside shovel work, the railway track work, and trench digging. They do nearly all of the mortar mixing and hod carrying (only their "hods" are four-gallon tin oil cans). They are not allowed to go underground. A Greek woman is the best hoist runner about the mine. The mine superintendent is emphatic in his declaration that they are "the best men on the job." They wear long dresses like our grandmothers. Oftentimes a family applies for work and the man does not care for it unless the wife is also given a job.

The geology of Cyprus has been touched upon only as



Skouriotissa, Cyprus. A part of the native village in the right background; and, in the right foreground, an ancient slag dump. A wheat field at the left.

related to the company's mines. It might well form the subject of a separate article. The mineralogy of this ore likewise might easily form a subject for an entirely separate paper.

"Pillow-lava" is a term which I do not recall ever hearing before, and I do not find it in any standard work to be found here. It is used by Cullis and Edge for a peculiar formation of andesite supposed to have been extruded under the sea and mingled with soft sea-bottom formations. The matrix is said to show microscopic forms of submarine fossils. It consists of rolling dumpling-like masses indicating more rapid cooling at the crust. These rocks constitute a plentiful formation throughout the island. There are good exposures at the seashore and in the canyons. English geologists seem unreservedly to adopt the theory of the submarine formation of these lavas.

Many ancient slag dumps are scattered over the island, some so small as almost to escape notice when nearly covered by wash and vegetation. Some do not seem to be in a mineralized locality and may have been chosen because of the availability of charcoal fuel, small tributers bringing their ores thence. In those days, as always, there were doubtless near-mines and superficial concentrations, soon exhausted. Two general types of these slags exist, the red dumps generally credited as of Phœnician date, and the later and larger masses, doubtless Roman. At Skouriotissa are both the red Phœnician and the black Roman slags. The Phœnician dump is so irregular and so buried by the wash from the mountain and by the Roman dump that its extent can only be crudely guessed. The Romans may have taken some of the Phœnician slag for furnace operations.

One theory is that the entire Roman dump is the result of resmelting the older slags, the Romans leaving only the parts of the older pile that were too lean in copper. The appearance and relative positions of the two dumps support such a view. It may be noted that the Galen account mentions no operations except those connected with the mineral waters and furnace operations. It seems more reasonable to think that the Romans used at least a small quantity of raw ore as a component of their furnace charge.

The Roman slag dump extends for 2,200 ft. along the base of the mountain, 65 ft. high in places. Its base width cannot be told, because the uphill side is buried by centuries of wash. Its top is not level like that of modern slag dumps. It is largely made up of flat chunks about 4 in. thick, showing that the slag was first poured out on a level surface to cool and then broken up and carried to its present position, making the great dump a series of hillocks. It seems to have undergone no alteration. Where excavations have been made for road ballasting the material all looks the same as at the surface. In the 1,500 years since the last of it was made, there has been only enough wind-blown dust lodged in a few spots on its surface to hold the roots of a few small weeds. The great mass, black, bleak, and barren, still frowns down upon the numerous olive orchards, wheat fields, and gardens below.

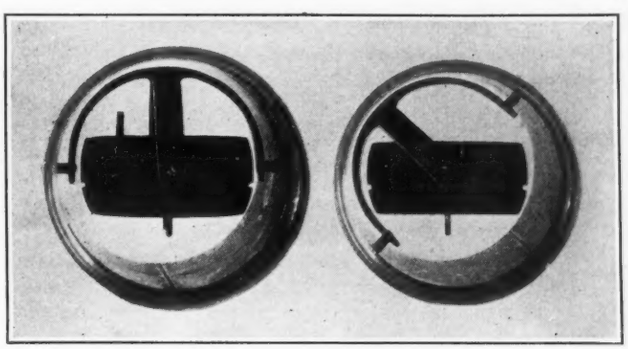
Twelve kinds of fruit trees growing at the base of the ancient slag dump

At the left, a water-power grain mill. On the horizon, a churn drill penetrating the Mavrovouni orebody. Oranges, lemons, sweet limes, figs, dates, pomegranates, mulberries, myrtleberries, blackberries (a tree-climbing vine), prickly pears ("Egyptian figs"), quinces, olives, peaches, plums, apricots, almonds, mespholos, medles, carobs, and walnuts—also oak, pine, and poplar trees—are growing within the range of this picture. Bananas and caishas are not far away. The ancient slag dump shows through the foliage and extends down partly beneath the soil of this orchard.

Borehole Surveying at the Homestake

By Lawrence B. Wright
Chief Geologist, Homestake Mining Company, Lead, S. D.

DRILLING in steeply dipping, severely laminated and schistose Pre-Cambrian rocks in the Homestake mine and vicinity gives rise to problems in borehole deviation which are hard to solve accurately and economically. These problems challenged the ingenuity of the Homestake engineering staff, with the resultant development of the instrument described below. This device was the result of much experimenting and of several attempts to obtain accurate surveys without a big expense in first cost and operation of instruments.



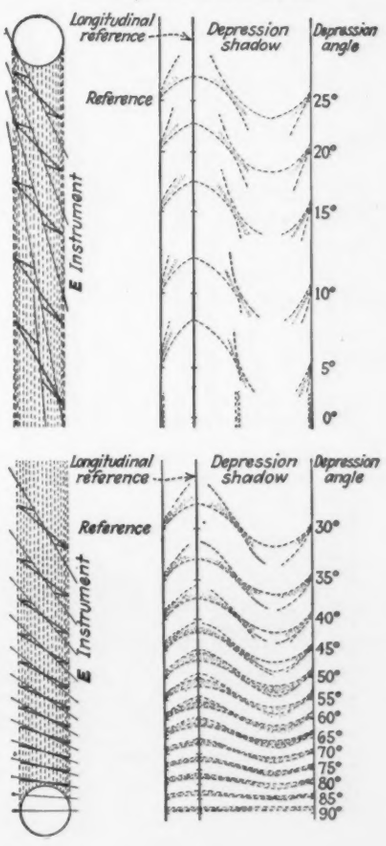
Surveying instrument with ends removed

Arthur B. Yates, geologist, A. A. Lease, photographic expert, and I have made numerous surveys underground and in the laboratory with this type of instrument, endeavoring to get away from the obstruction of the compass needle by any substance and, in fact, doing away with the use of liquid substance. We sought to eliminate light bulbs, timing devices, and wires leading into the bore. To meet these conditions it was necessary to mount a needle on a member which would be held in horizontal position by gravity and to have this member definitely related to some other portion of the instrument which would always be parallel to the direction of the bore at the point where the reading was to be taken. A cylindrical shell was adopted and a reference groove cut along the inside of the shell, the pendulously mounted needle member being attached to a ring or cradle pivoted on the shell.

The direction of the hole is recorded by means of a photographic film which receives the impression of the needle through the agency of radioactive material placed on the under side of the needle, there being more of it on the north end than on the south end. The film is mounted on the cover glass above the needle on one model and under the needle on another model. It (the film) is kept from rotating by means of a suitable spring-wire clamp. The cover glass mounting gives the best results if a thin glass is used.

To obtain the inclination of the hole from the horizontal, the inside circumference of the outer shell is lined with photographic film, cut from a pattern to fit. The impression in this instance is recorded through the agency of radioactive material which is placed in a groove about the circumference of the needle mounting. Theoretically, the cylindrical film, when taken out and developed, should show a curve corresponding with the intersection of a plane with the cylinder at the inclination of the hole at the point surveyed. However, experiments with the instrument soon disclosed other factors of light dispersion due to the varying distances of film from the "horizontal-plane" radioactive material, necessitating the making up of a set of model curves, combining theory with practical results. Fig. 1 indicates the method used in developing this set of curves. It is possible to interpolate to within one degree, we believe, by placing the developed film over the inclination curve diagram and noting the variation between the nearest two curves. The reference line (vertical) shown on this diagram is always parallel to the direction of the hole. It does not matter what position of rotation the instrument takes in the hole, as there is a reference dot made on the direction film which bears a constant relation to the reference line. The curve shown in Fig. 2 is based on this relationship and indicates the correction in orienting the compass needle impression that is to be made in calculating the true magnetic direction of the bore.

Fig. 1 — Indicating the method used in developing model curves for obtaining inclination of borehole from horizontal



As the crest of inclination curve varies with respect to the longitudinal reference line, so does the reference dot on the direction film vary in proportion and must be rotated through a corresponding arc (the amounts shown in the diagram, Fig. 2) before the true position of the needle impression is reached with respect to the longi-

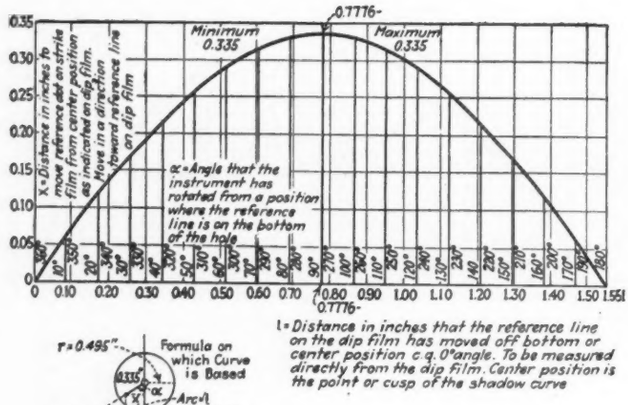

Minimum 0.335
Maximum 0.335
0.7776-
X = Distance in inches to move reference dot on strike film from center position as indicated on dip film. Move in a direction toward reference line on dip film
α = Angle that the instrument has rotated from a position where the reference line is on the bottom of the hole
l = Distance in inches that the reference line on the dip film has moved off bottom or center position. e.g. 0° angle. To be measured directly from the dip film. Center position is the point or cusp of the shadow curve
r = 0.495"
Formula on which Curve is Based
Arc = l
Angle = α
r = 0.495"
2πr = 3.1102"
or:- l = 3.1102 x α / 360
and sin α = x / 0.335
or:- x = 0.335 x sin α
Subst l = 3.1102 (sin α x 0.335) / 360

Fig. 2—Curve indicating correction to be made in calculating true magnetic correction of bore

tudinal reference line, or direction of the hole. With due care on the part of the person making the calculation, the direction of a hole can be read to within one or two degrees.

The cross-reference line (broken so as not to cloud the film) gives the proper orientation of the inclination curve in case the film should not always be in the same position in the instrument, and is necessary to the proper orientation of the inclination curve on the curve diagram.

The question that has most often been asked in regard to the operation of the instrument is, "How is it possible to make this photographic impression clear when the film is exposed to the action of the radioactive material while the instrument is being lowered into the hole?" The answer is that the instrument is in motion while this is taking place and that there is not sufficient light to cloud the film sufficiently to prevent a good clear impression being made when the instrument is left at rest for from fifteen to twenty-five minutes. The photographs of the films shown illustrate the results thus obtained.

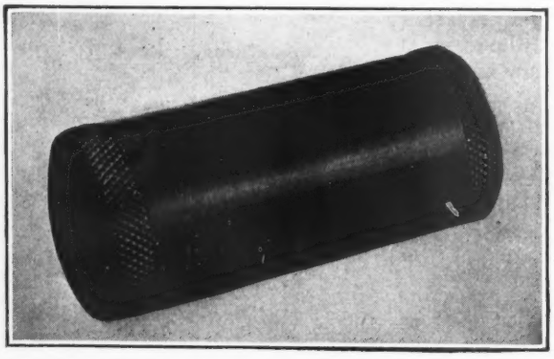
The instrument used is only 1⅛ in. in diameter, and will fit the usual standard bronze equipment for borehole surveying of "E" size. The same instrument can be used in larger equipment, but of course a larger instrument would give more accurate results.

Surveys can be made at any angle below or above horizontal. Water does not interfere, should the equipment leak. No difficulty has been met in keeping out water, however.

The instrument can be manipulated with daylight loading apparatus, the films removed and developed on the job or later as may be most convenient under the circumstances.

We are greatly indebted to Robert D. Longyear, president of the E. J. Longyear Manufacturing Company, Minneapolis, Minn., for many helpful suggestions and also to Wm. Ainsworth & Sons, Denver, for close cooperation in the manufacture of the various instruments. The instrument is patented in Canada; the United States patent is pending.

Borehole survey instrument with ends of cylinder in place



Xanthate and Pine Oil Float Native Copper In Amygdaloid Ores

Large Savings to Michigan Copper Industry Likely to Result From Bureau of Mines' Experiments

By A. W. Fahrenwald
Ore Dressing Engineer, U. S. Bureau of Mines, Houghton, Mich.

CO-OPERATION was recently arranged between the mine operators, the Michigan College of Mines and Technology, and the U. S. Bureau of Mines, for a study of present milling practice in the copper district of Michigan. Work was actively begun in January, 1928, and in six months most encouraging results have been obtained, which promise to achieve large savings in commercial practice. The problem and its solution are described in the following report, issued by the Bureau of Mines:

Copper occurs in Michigan almost wholly in the native state, only an insignificant amount of copper sulphide being present. The native copper occurs in two general classes of formations—amygdaloid and conglomerate. In respect to ore dressing, the outstanding peculiarities of the two types are: In the amygdaloid, the particles of native copper are relatively coarse and are almost entirely liberated at approximately 48-mesh comminution, largely in a flaky condition. In the conglomerate, the metallic copper is extremely finely disseminated and is not completely liberated by crushing even to minus-200 mesh. The present study has been confined almost wholly to amygdaloid ores; the conglomerate ore is being efficiently treated in current practice.

The amygdaloid ore contains a siliceous gangue, of which 80 per cent has a specific gravity of less than 2.84, 92 per cent of less than 2.94, and 98 per cent of less than 3.17. Epidote, of 3.25 specific gravity, is noticeably present and accumulates on the concentrating tables, making clean concentrate and middling difficult to secure. The nature of the amygdaloid ores varies a little from mine to mine, but the general characteristics are the same, as is shown later by flotation tests.

Amygdaloid ores have been milled by straight gravity-concentration methods, using principally jigs and tables. Current practice is well described in Taggart's "Ore Dressing," pages 77 to 82. Jigs treat classified and unclassified feed and make coarse copper concentrate, middling which is reground, and sometimes a tailing. At nearly all of the plants jig tailing is reground and tabled.

Steam stamps are used to reduce the mill feed to minus

$\frac{3}{16}$ in. or minus $\frac{3}{8}$ in. Large chunks of mass copper are hand-picked ahead of each stamp and smaller mass copper is intermittently recovered in the stamp mortar by a hydraulicking device. The $\frac{3}{8}$-in. or $\frac{3}{16}$-in. copper is caught in jigs and on tables. The stamp discharge is run either to Woodbury desliming jigs or to Tamarack classifiers. Overflow from either of these devices passes a 14- or 20-mesh Tyler sieve and is the present primary table feed. The tables in the mills treating this material are called by the operators "slime tables." The desliming jigs make a cup concentrate, a hutch concentrate which is further treated on jigs and tables, and a tailing which generally is reground and tabled. In the mills using Woodbury slime jigs, the jig overflow, or primary table feed, is roughly 40 per cent of the stamp head feed. When the stamp discharge goes to Tamarack classifiers, the overflow or primary table feed is approximately 22 per cent of the total feed. All tables make a rougher concentrate, a middling, and a final tailing. The rougher concentrate is recleaned on additional tables, and the middling is reground and retabled. The grade of table concentrate is approximately 35 per cent copper, and the copper loss in the tailing is roughly from 4 to 7 lb. copper per ton of tailing.

In the Michigan district there are about 25 stamps dropping on amygdaloid ore, crushing approximately 16,250 tons a day. Of this tonnage, about 5,400 tons is primary table feed. The total table feed tonnage, however, is much greater, owing to the grinding of jig tailing.

Fine Grinding Not Necessary to Unlock Copper in the Ore

Heavy-liquid segregations and microscopic examinations of crushed amygdaloid ore indicated that comminution of the ore to a size equivalent to present primary table feed left only about $1\frac{1}{2}$ lb. of copper per ton locked with the sand. This seemed at once evidence that the gravity tables were not catching all of the free metallic copper, and that the table-middling regrind practice was not accomplishing its purpose. Laboratory table-concentration tests on primary table feed, paying special attention to feed preparation, failed to give encouraging results. Microscopic examination of the metallic copper in the table tailing showed clearly the abnormal shapes of the copper grains and that much flaky and fine copper was escaping. The possibility of flotation was immediately suggested by this observation. However, metallic copper in the amygdaloid ore had been thought to be too coarse to float; earlier attempts at flotation, it is said, gave negative results.

Table I

Mesh Tyler Standard Sieve	Sample A — Per Cent Weight Actual	Sample A — Per Cent Weight Cumulative	Sample B — Per Cent Weight Actual	Sample B — Per Cent Weight Cumulative
On 35	4.14	4.14	9.36	9.36
−35 +48	10.34	14.48	14.32	23.68
−48 +65	15.90	30.38	18.79	42.47
−65 +100	19.39	49.77	22.32	64.79
−100	.....	.....	35.21	100.00
−100 sand	37.63	87.40	.....	.....
−100 colloidal	12.60	100.00	.....	.....

In the present investigation several pounds of table concentrate were collected for flotation experiments. When the proper reagent combination had finally been found, copper as coarse as 28 and 35 mesh floated quite well, and minus 65-mesh copper floated readily. Flotation was still easier when the copper was mixed with a pulp of finely ground barren rock to increase the density of the suspension medium and thereby decrease the settling velocity of the copper sand.

Samples of primary table tailings next were collected and subjected to flotation tests. Screen analyses of typical table feeds are shown in Table I.

From a table tailing assaying 0.21 per cent copper, a flotation tailing assaying 0.08 per cent copper was made. The rougher concentrate assayed 27.80 per cent copper. From another table-tailing sample assaying 0.22 per cent copper, a 0.06 per cent (1.2 lb. per ton) copper tailing was made, with a rougher concentrate assaying 41 per cent copper. The concentrate observed under a binocular microscope consisted of fine free copper, flat copper, and true middling.

Original table feeds of the various operating mills were floated next. The general results obtained and a comparison of them with results of present practice are shown in Table II.

Table II

Material	Mill Number 1	2 (a)	2 (b)	3	4
Pounds copper per ton feed	6.80	7.2	11.2	12.0	5.8
Pounds copper per ton table tailing	3.68	4.20	4.68	5.0	3.8
Per cent copper in table concentrate	33	33	33	33	33
Pounds copper per ton flotation tailing	1.60	1.20	1.66	3.0	1.6
Per cent copper in flotation conc	75	75	75	75	75
Pounds copper per ton saved by flotation	2.08	3.00	3.02	2.0	2.2

The percentage of copper in the table and flotation concentrates is approximate only. On some samples, tailings carrying as little as 0.06 per cent copper were repeatedly obtained.

Xanthate in a slightly alkaline pulp in conjunction with a variety of oils was the reagent combination used. Lime or sodium carbonate or sodium dibasic phosphate in small quantities gave satisfactory alkalinity. Sodium dibasic phosphate was the best of these substances; a given quantity was satisfactory, regardless of the mill from which the table-feed samples were taken. Lime or soda ash called for closer regulation. The mill water was slightly less than pH = 7 and a pH of 7.5 to 8 was required. The pine oil used was Barrett No. 4 and No. 5 steam-distilled. Of the reagents so far tried, xanthate was required to give positive results. Further investigation may disclose other successful combinations of flotation reagents.

Better Recovery and Lower Costs Obtained by Using Flotation

The laboratory tests indicate that the following items of saving are possible by use of flotation instead of the all-gravity process:

1. Additional recovery of copper.
2. Lower smelting cost of concentrate.
3. Lower slag loss.
4. No table middling to regrind.

Considering an average additional recovery of two pounds of copper per ton by flotation, over that secured by tables, the district would yield without any additional grinding 10,800 lb. more copper per day, or, on the basis of 300 operating days per year, 3,240,000 lb. of copper more per year. If the entire tonnage of amygdaloid ore be crushed to flotation feed (—20 mesh)— and crushing is already nearly all to flotation size in one mill—flotation would give an additional recovery over present practice of roughly 10,800,000 lb. of copper per year. To reject a ton of rock at the smelter in the form of slag costs approximately $10, and the loss of copper in the slag is about 0.8 per cent. These, also, would be large items of saving.

As a result of these preliminary experiments plans are now well under way thoroughly to try out flotation of amygdaloid copper in the various plants in Michigan that are operating on these ores.

COMMENT AND CRITICISM

In Quest of the Opal

THE EDITOR:

Sir—When other trades fail, try "opaling." Such is the advice of a miner who sailed for Australia, and, with a negligible amount of capital, went "digging." In a few years he found himself well-to-do. Selling his claim, he turned opal dealer, and today he is what is locally known around the mines as a "warm man." The newcomer certainly had luck. His initial find, a week after pegging the claim, was a fine orange pin-fire, a really valuable stone. Any beginner might, by the way, have experienced similar good fortune, it being merely a question of chance.

Black opals fetch considerably more than the twinkling, orange pin-fire, though why they should be preferred to the more beautiful of the two stones is a mystery.

To be an "opaler" no technical knowledge is required, beyond knowing ironstone when one sees it. Under this kind of deposit the most brilliant, the most fiery, opals hide themselves. Clay also harbors them, in strata and at all depths—down to, say, 50 ft. Sometimes they are embedded near the surface of the 6-ft. shaft. The next 40 ft. may yield nothing but disappointment. Since the width of the shaft in an opal digging is only about 3 ft., descending and ascending are simple matters. No expensive machinery is required; no vexatious investment of capital. Indeed, "opaling" is a satisfactory calling for a poor man—sometimes a remunerative one.

The miner usually takes two partners, and the three dig, keep the table supplied with game, and cook, turn and turn about. The arrangement is a good one, for if digging and cooking are, respectively, tiring and tame occupations, a "find" is exciting. To stalk and bring down something worth eating is almost as exhilarating as finding a black opal—or the more lovely orange pin-fire. Should the game prove coy, or the sportsman a bad shot, the "opalers" must fall back on uninteresting stores obtained from the nearest settlement.

If a stratum, after being worked vertically, still looks promising, the miner follows it before sinking deeper. An English "opaler," being undecided, tossed up to determine whether to continue or to try another level. Having used a foreign coin, he could not tell the head from the tail. So, taking no chances, and regarding his ignorance as a good omen, he went on digging horizontally. Three opals rewarded the effort, and one of them proved to be a real beauty.

Opal buyers visit the township from time to time, buying all stones that are offered them and paying fair prices. Occasionally the miner takes his opals to Brisbane or to Sydney, believing that by doing so he will strike a better bargain. He also has a jaunt in his mind's eye, for it is possible to tire of the mining camp. GEORGE CECIL.

Paris, France.

Mining Promotion in Idaho

THE EDITOR:

Sir—In regard to the editorial in the issue of May 12, "How Much Capital Goes Astray Thus?" anent the operations of the Idaho Gold & Platinum Annex Mining Company, I am inclosing a letter sent them under date of June 12. STEWART CAMPBELL,

State of Idaho, Inspector of Mines.
Mining Department, Boise.

June 12, 1928

Mr. E. A. Thom, Secretary,
Idaho Gold & Platinum Annex
Mining Company,
P. O. Box 841, Reno, Nev.

Dear Sir:

Our attention has been called to the fact that your company is purporting to own mining property in Idaho, and that your stock is being actively distributed, advertised, and assessed. If we are correct in the above statement, don't you believe it would be a good idea for your company to qualify to do business in Idaho and comply with the necessary laws before offering your stock to the public? In such an event, the holders of your stock would at least have a valid certificate.

Section 4776, Idaho Compiled Statutes, relative to foreign corporations holding property in Idaho when the articles of incorporation have not been filed and a statutory agent named, provides as follows:

> "Such corporation can not take or hold title to any realty within this state prior to making such filings, and any pretended deed or conveyance of real estate to such corporation prior to such filings shall be absolutely null and void. ('03, p. 49, H.B. 45, Sec. 1.)
>
> *"Construed:* This section is mandatory and any conveyance made to a foreign corporation that has failed to comply with it is null and void. Dickens-West M. Co. *v.* Crescent, etc., Co. (1914) 26 I. 153, 141 P. 566"

A copy of the Idaho mining laws has been mailed to you under separate cover. Your attention is called to Section 5320-A, page 3 of the supplement, relative to filing advertisements in this department. Your attention is also called to Sections 5319 and 5320, page 15 of the pamphlet, and the necessary form for filing report in accordance with these sections is inclosed.

It is our suggestion that you comply with these requirements immediately.

Very truly yours,
(Signed) STEWART CAMPBELL.

[A correspondent from Reno, Nev., the seat of promotion operations, sends us a clipping from a local paper, giving an imposing list of persons holding an aggregate of 277,192 shares in this company, who have failed to pay the assessment levied on April 20. The statement concludes with the warning that " . . . in accordance with law and a resolution of the Board of Directors, passed on the 20th day of April, 1928, so many shares of each parcel of said stock as may be necessary for the payment of such assessment delinquent thereon, together with the costs of advertising and expenses of sale, will be sold at public auction, at the office of the company, 239 North Virginia Street, Reno, Washoe County, Nevada, on the 20th day of June, 1928, at the hour of two o'clock, P.M., to the highest bidder for cash. . . ."

It would appear that many stockholders are not anxious to speculate further in this enterprise, despite the announcement of "positive values of immense proportions having been proven through our numerous assays; the gold content alone is of such great value as to stagger the imagination of both the layman and expert."

The layman, be it observed, is staggering away. The "expert" is still at the old game.—EDITOR.]

Fine vs. Coarse Grinding

THE EDITOR:

Sir—In your issue of June 16 are some comments on my article of Feb. 18, 1928. I could cite a hundred instances where grinding all to pass 200 mesh for flotation would be undesirable. I could personally cite none to the contrary, although there are isolated instances where 200 mesh is necessary to free practically all of the mineral from the gangue. One example will suffice—let us take the case submitted by Mr. M. E. Playford. We will take his test No. 1 and his last, which is No. 6, all of the others being

intermediate between these two except in very minor details. No. 1 shows that the loss in the plus 50-mesh material, after flotation, constituting 11.2 per cent of the weight, has 9.25 per cent of the original minerals still locked up in it.

Weight	Mesh	Per Cent of the Value
11.2	Plus 50	9.25
17.2	50 to 80	7.79
10.6	80 to 120	1.48
8.2	120 to 200	0.57
52.3	Minus 200	1.83
99.5		20.92

Therefore 20.92 per cent represents the loss from all sizes. In test No. 6, which is much finer ground, results are as follows:

Weight	Mesh	Per Cent of the Value
0.5	Plus 50	0.40
2.9	50 to 80	1.50
6.1	80 to 120	1.07
9.5	120 to 200	0.95
81.0	Minus 200	0.40
100.0		4.34

Therefore 4.34 per cent represents the loss from all sizes.

Mr. Playford's figures conclusively show that had the plus 80 mesh alone been reground his ore would have been beneficiated more by grinding this 28.4 per cent than his entire extra amount of grinding accomplished, assuming that the reground material is distributed in the same proportions as was the original material. The further he grinds, the more accentuated become the benefits to be derived by grinding the coarse instead of the material already fine. Even the one-half of 1 per cent of plus 50 mesh in Test No. 6, not considered worthy of notice by Mr. Playford, contains as much metallic mineral as what is left in the entire 81 per cent of the minus 200 mesh, while the plus 120 mesh in the finest ground (Test No. 6) still shows more valuable material than there was in the coarsest ground (Test No. 1) in all the minus 120 mesh material—namely 3.0 per cent and 2.40 per cent respectively. I assume from his statement that the values in the intermediate sizes are practically constant. At the finish of what he cites as proof of the benefits of fine grinding there is 160 times the inducement to grind a ton of plus 50 mesh material, if it could be segregated, than to recover all of the remaining minerals in a ton of the minus 200 if that were possible by further grinding. I apologize for assuming that all the fractions assayed the same, but have been cited no other data on which to base conclusions.

With ore breaking largely at random in three directions, we necessarily have a large percentage of finer sizes, and I certainly disagree, as will the majority of engineers, with Mr. Playford's statement that the general tendency of grinding practice for flotation in recent years has been toward the higher percentage of minus 200-mesh material in the feed. The truth is that the tendency has been to cut down the percentage of the coarser sizes, say above 48 mesh (Tyler scale), and the production of more 200 mesh simply followed as an unavoidable consequence.

I have before me the April, 1928, issue (No. 8) of the Quarterly of the Colorado School of Mines, by Professors Weinig and Palmer, entitled, "The Trend of Flotation." On page 22, fourth paragraph, it states, "Before the advent of flotation one of the objects in crushing and grinding was to produce as small a proportion of slimes as possible, because very finely divided ore was unsuited to table concentration. In grinding for flotation, the operator is concerned mainly with the unlocking of the minerals, the tonnage put through, and the conservation of power. Much sliming, however, sometimes is very undesirable, and any overgrinding should be avoided, because it is unnecessary and means an increase in the power costs." And further on (page 23, paragraph 5, last sentence), "A large amount of oxidized slime is prejudicial to good flotation." Similar statements from authorative sources are the rule. In regard to the quotation, if my statement can be termed a quotation, I fail to see where "Material crushed at 71.4 per cent through 200 mesh yielded a better extraction than the former standard method yielding 77 per cent through 200, the gain being from the finer crushing of the intermediate sand," can possibly mean anything other than that the extraction is improved by crushing of the coarser rather than the finer material. Still further crushing of the coarser particles would continue to improve the extraction, and the increased amount of minus 200 mesh produced is merely unavoidable. The finer intermediate sizes are the most desirable to produce, because the slimes cost the most money to produce. The 81 per cent minus 200 mesh cited is a long, long way from *all* 200 mesh, and *all* 200 mesh is the basis of the discussion.

It appears to me that Mr. Playford has failed to analyze his own results carefully. JOHN HERMAN.

Los Angeles.

Copper Kitchen Utensils

THE EDITOR:

Sir—An editorial in a recent issue spoke of the advantage to the human system of small amounts of copper, this matter having been the subject of experiments during the last year or two, the results of which were disclosed at a scientific meeting at Ann Arbor, Mich., this spring. In a subsequent issue, Mr. Jesse A. Zook called attention to the fact that our forefathers used copper kitchen utensils, and suggested that they may have been wiser than they knew, the small amounts of copper thus being introduced into food being an aid to health.

Is it not a fact that the copper utensils that graced the Colonial kitchens were invariably tinned on the inside, and that no copper was thus allowed to come in contact with the food being cooked? This, I have always understood, was one of the chief reasons for discarding copper utensils, for they had to be re-tinned every six months or so; also, it was not easy to keep them polished. Copper is rather easily attacked by salt and by some of the acids commonly used in cooking, such as vinegar, and presumably the amount of copper that would be introduced into food by free contact with copper cooking utensils would be considerablly larger than would be good for the most anemic person.

The beauty of copper is becoming more and more recognized, and copper utensils are now on the market which are silver plated on the inside. This makes a utensil of rather excessive first cost—say ten or fifteen dollars for a saucepan of ordinary size—but the plating is said to wear indefinitely if not abused. Those interested in increasing the demand for copper and silver, and incidentally adding a thing of beauty to their kitchen range and dining table, might do well to buy a piece of this ware. It is for sale in most department stores, and those who live in New York City can find an excellent selection at the Joseph Heinrichs store, on the east side of Broadway, just below 23d St. E. H. ROBIE.

New York City.

Gee-oh-sigh-kickle Proshpectin', Sor!

MISTHER EDITOR:

Sor—'Tis wonderful the great advances scientists do be makin' these days. Not for a long time hav I ventured to write annything about minin', bein' afraid to show me ign'rance, like.

But yisterday me old fri'nd T. Montmorency Dillon dropped in to see me an' buy the lunch. "Bill," sez Tim, "what do yez know about this here gee-oh-sigh-kickle proshpectin'?"

"Not a damn thing at all, at all," sez I. "Is it a new-fangled way that the college lads have av runnin' motorcycles cross-country to luk at the rocks?"

"Yez don't know the half of it," sez Tim, whirlin' his thumb on wan av thim scientific cigar lighters. "Thanks for the match, Bill," he raysumed, "I filled the thing only yisterday, but the stuff evayporates quick. Now, about this here new proshpectin'. There's dozens an' dozens av different ways av goin' about it. Some uses pendylumbs, some plugs into the ground with high-voltage rods an' takes readin's av the raysistance an' stray earth currents an' sich like; while manny av thim uses the raydio sets that iverybody do be turnin' in for exchange whin they buys the new all-elictric super-Rolls-Royce kind. But the funniest av all is the kind that is operated by a sigh-kick himself."

"Wait a minute Tim," sez I, gettin' rid av me Ivanhoe cud, "Now what the hell is a sigh-kick, annyhow?"

"Sure," he grins, "ask me somethin'

easy. I dunno exactly. All I know is that he's wan av these here wild-eyed guys that talks queer an' sez he's all tuned in with his sigh-kick control. Until last month I wud hav said they was all damn liars, crazy fools an' spiritualists. But this bird I hav in mind pulled off stuff out in the Percolator oil field av Wyoming that makes me wonder if there isn't some kind av human raydio emmanayshuns that the orthydox scientists haven't found out about yet. This Finlander I'm tellin' ye about is the cat's whiskers, for he staked out all the auntykleins an' structures an' domes an' things, tallyin' to the dot with the highest-priced petrolyum geeollyjist in the country. An' him niver in the State av Wyomin' even, till the day before. Cat's whiskers is right, all right, for we tried to fuddle him at the hotel next day. I tuk a hunk av galena crystal an' hid it wan place an' another, all over the buildin'. An' that crazy son-of-a-gun locayted the spissimen ivery time—that is, ivery time but wan. That time it was in the toe av an old rubber boot in the back alley. Whin I told him where it was, after he had give up in disgust, he shook his head sadly an' said he didn't know why, but rubber or annything like that made it impossible for him to get his sigh-kick vibrayshuns. All av a sudden it dawned on me, like. Human raydio, it must be, an' the rubber insulaytes the magic juice.

"Whin I told old Santy Claus how his work checked with the high-priced geeollyjists, he tuk the last drink in the bottle an' rumbled out, slow an' solemn, that whin the geeollyjickle work wuz done honestly an' conshyenshusly by experienced men, it usually harmonized with his stuff."

Now, misther editor, I crave yer forgiveness for takin' up so much valy'ble space in yer paper, but do yez not think that the highbrow scientific sosyetys shud luk more seryusly an' minutely into ivery branch av this wonderful gee-oh-sigh-kickle proshpectin'?

BILL MCGINTY

Oshkosh, Mass.

Copper as a Contaminant of Manganese Ore

THE EDITOR:

Sir—In your issue of June 23, 1928, referring to analysis of Georgian chemical manganese ore, the percentage of copper is given as 0.03. This alone should make it unfit for use in dry batteries. The maximum allowable percentage, specified by the majority of American battery manufacturers, is 0.025. Some are using ores containing a larger amount of copper, but this element has always been considered by dry-cell manufacturers as one of the most deleterious impurities.

CHAS. A. HYDAR,
General Superintendent,
Trout Mining Company.

Philipsburg, Mont.

Rare Metals in Western Petroleums

THE EDITOR:

Sir—The editorial entitled "Whence Come the Metals Associated With Petroleum?" published in the June 23 issue of *Engineering and Mining Journal*, recalls an interesting point in connection with certain fuel-oil investigations conducted by the Copper Queen laboratory during the early part of 1926.

It was found during the course of the investigation that the ash from all fuel oils received from California fields showed the presence of nickel and vanadium. Nickel was present to the extent of 0.003 per cent of the original oil, and vanadium occurred in somewhat greater amount. Fuel oils received from Oklahoma fields were entirely free from these elements, a fact which was made use of in distinguishing between scales formed on Diesel engine piston heads when California and Oklahoma oils were used during different operating periods.

The occurrence of nickel and vanadium in California oils may be well known, but at any rate the matter was of considerable interest in comparing oils from different localities.

Douglas, Ariz. L. L. MCDANIEL.

Consultation

U. S. Quicksilver Production

"I am attempting to secure a list of the producing quicksilver mines of North America. Can you furnish me with such a list? Also, I would like to know what the domestic quicksilver production has amounted to, in proportion to exports, in recent years."

A recent compilation, in which reliable authorities have co-operated, indicates the following producers of quicksilver in North America. Our readers are invited to submit additions or corrections to this list:

Alpha Quicksilver Company, Wilbur Springs, Calif.
Arizona Cinnabar Company, Globe, Gila County, Ariz.
B. & B. Quick Company, Arlemont, Nev.
Blackbutte Quicksilver Mine, Carlton, Ore.
Chisos Mining Company, Terlingua, Tex.
Goldbanks Quicksilver Company, Winnemucca, Nev.
Kings Quicksilver Mining Company, Ltd., Parkfield, Calif.
Knoxville Mine, Monticello, Napa County, Calif.
La Jova Mine, Oakville, Napa County, Calif.
Marisal Mining Company, Marathon, Tex.
Mercury Mining Company, McDermitt, Ore.
Monumental Mercury Mines Corporation, Valley County, Idaho.
New Almaden Quicksilver Mines Corporation, New Alamaden, Calif.
New Idria Quicksilver Mines, Inc., Idria, Calif.
New Guadalupe Mining Company, Los Gatos, Calif.
Oceanic Quicksilver Mine, Cambria, Calif.
Oat Hill Mine, Middletown, Napa County, Calif.
Pershing Quicksilver Company, Pershing County, Nev.
Pacific Quicksilver Company, Palmville, Ore.
Section No. 39, Alpine, Tex.
Sulphur Bank Mine, Clearlake, Calif.
Western Mercury Company, Inc., Cloverdale, Calif.
Yavapai Mercury Mining Company, Phoenix, Ariz.

The following table abstracted from a compilation by J. W. Furness, of the U. S. Bureau of Mines, answers your question with relation to recent production statistics:

Year	Domestic Production Flasks	Domestic Production Value	Imports for Consumption Flasks	Imports for Consumption Value
1923	7,937	$521,302	18,073	$816,043
1924	10,085	692,739	13,170	566,820
1925	9,174	762,616	20,855	1,200,878
1926	7,642	702,323	25,976	1,784,250
1927	11,276	.....	24,650	2,189,495

A small amount of quicksilver was exported in each of the above years, but the proportion is relatively insignificant.

Prior to June, 1927, the net weight of the standard flask was 75 lb.; since June, 1927, the standard flask has contained 76 lb.

What Is Mercurochrome?

"What is the composition of the new germicide mercurochrome, which seems to have so nearly superseded tincture of iodine? Is it true that this product contains appreciable quantities of mercury and chromium, as the name suggests?"

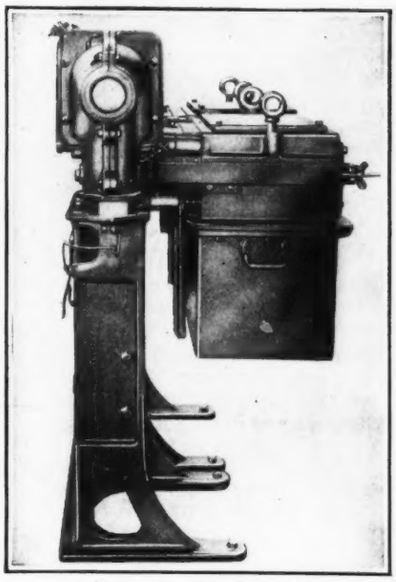
Mercurochrome is a mercury compound of a complicated organic substance, known technically as dibromoxymercuri-fluorescein. The materials which go into its use are phthalic anhydride, of naphthalene origin; resorcinal, related to carbolic acid and of benzene origin; bromine, and mercury. Hynson, Westcott and Dunning, manufacturers of this new germicide, state that its theoretical mercury content is 26.6 per cent, bromine 21.3 per cent. In explaining the significance of the name, the above named firm is authority for the statement that "Mercuro" indicates that the material is a mercurial compound, and that "chrome" refers to its being a color substance.

Although containing an appreciable quantity of mercury and bromine, the germicide is non-toxic in extravenous use and is being used intravenously in dosages as large as five milligrams per kilogram of body weight. Also, it is administered by mouth in dosages as large as 12 grains per day with non-toxic results. A big advantage over iodine is the lack of pain and irritation occasioned by its application to open cuts and sores. For this reason the germicide finds particular favor with small children.

INDUSTRIAL PROGRESS

Safety to Life and Property Assured by New Switchgear

SWITCHGEAR of a type practically new in American practice, though long used in Great Britain, is now being introduced in the United States by the Allis-Chalmers Manufacturing Company. This is Reyrolle "armor-clad" gear. Its general appearance is shown in the accompanying illustrations.



Type E hand-operated switch unit, 600 amp., 4,400 volts. Interrupting capacity 40,000 kva.

Before a description of this equipment is undertaken, it is well to state its advantages, which are certain to appeal to American mine operators. They are as follows:

1. It affords complete protection to human life. 2. It protects property against damage. 3. It secures continuity of service. 4. It reduces the possibility of human error to a minimum. 5. The over-all initial expense (Including the cost of switch buildings) is low. 6. It secures compactness of plant. 7. It is convenient to operate, and costs less to do so. 8. The maintenance expense is negligible.

As for range of application, the new switchgear at present is being used successfully for voltages up to 33,000 and is built in various sizes up to 1,500,000 kva. current-interrupting capacity. The smaller sizes, which are applicable to mining work, are described in this article. Type *E* is applicable for voltages up to 4,400 and has an interrupting capacity up to 40,000 kva. Type *C* is applicable to voltages up to 15,000, and has a current-interrupting capacity of from 75,000 to 150,000 kva.

A unit of the switchgear is shown in the accompanying drawing. It consists of a 3-phase circuit breaker with mountings and all auxiliaries. Contained entirely within it are the main oil breaker, busbars, disconnecting devices, instrument transformers, cable pot-heads, and necessary minor parts.

All live conductors in this assembly are either immersed in oil or solidly embedded in insulating compound. The whole is inclosed within grounded metal casings which form the exterior covering.

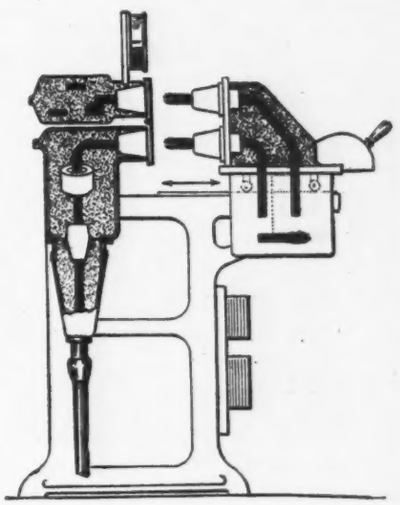
Disconnection is provided by withdrawal in a horizontal direction of the carriage-type oil circuit breaker. The orifices in the larger Type *C* gear are immediately closed by automatic locking-off doors, thus preventing accidental contact with the live conductors. Positive mechanical interlocks protect the operation of the panel.

For descriptive purposes, the component parts of each panel may be grouped under two headings, as follows:

1. The fixed portion.
   Busbar chamber.
   Instrument transformer chamber.
   Cable dividing box, or pot-head.
   Supporting framework.
2. Removable portion.
   Carriage-type oil circuit breaker.
   Operating mechanism.

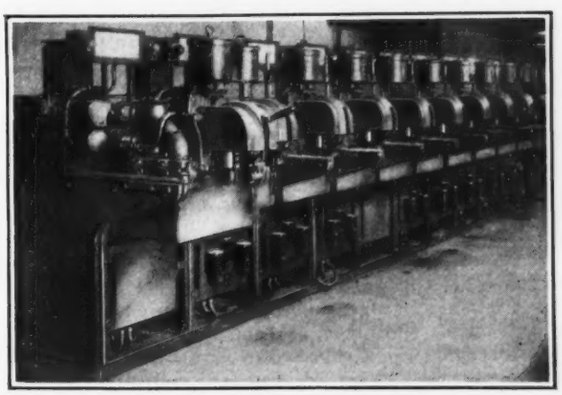
Busbars—The three busbars are of laminated copper adequately insulated and solidly compounded into a single metal chamber. The main disconnecting sockets are cast integral with the busbar chamber and are connected with their respective bars by laminated copper strips. The chamber is solidly filled with insulating compound before shipment.

Transformer Chamber—In the Type *C*, as shown in the line drawing, this is normally mounted below the busbar assembly and carries tubular orifice insulators and disconnecting sockets similar to those in the busbar chamber. The current transformers are mounted in the main body of the chamber,



Sectional sketch showing principal features of the Type C switchgear

which is filled with compound. The primary conductors extend through insulators in the chamber into the cable dividing box. In the smaller Type *F*, the current transformers are mounted in the chamber above the oil circuit breaker.



Group of Type C switch units, solenoid operated, 600 amp., 15,000 volts. Interrupting capacity 75,000 to 150,000 kva.

Cable Dividing Box—The main cables leading to the panels are accommodated in a cast metal dividing box bolted to the underside of the transformer chamber.

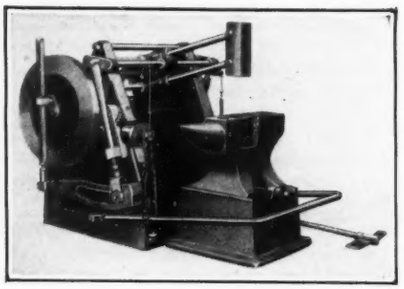
Supporting Framework—Two pressed steel standards support the component parts of the panel. Their upper faces are machined and provide a track for the rollers carrying the oil breaker. The breaker is moved out to disconnect by means of a hand lever and a rack and pinion.

Removable Portion—The oil circuit breaker is built as one complete unit having a single heavy steel tank supported from a cast-steel top plate. Above this plate are three hoods, through which the main conductors pass from the fixed contacts in the tank to the plug disconnectors, which engage with the sockets already described in the fixed portion of the gear.

The operating mechanism is mounted on the top plate of the breaker. Oil dash pots are provided so that, on opening the switch, the moving parts are brought to rest without shock.

Sparking contacts are of the butt or finger type, well proportioned and sprung. Two breaks in series per phase are provided, and the average velocity of the moving contacts is high. The breaking capacity is considerably above the rated value.

An important feature of this type of switchgear is that a group of units is usually completely assembled, connected up and tested at the factory, and shipped as a group. This largely eliminates the installation work in the field. All that is necessary is to connect the cables.



Improved model of power hammer for blacksmith shop

chine throughout, many of the dimensions having been changed. A larger motor is used, and the motor drive has been rearranged. The hammer is shown in one of the accompanying illustrations.

Machinery Exhibit Coming

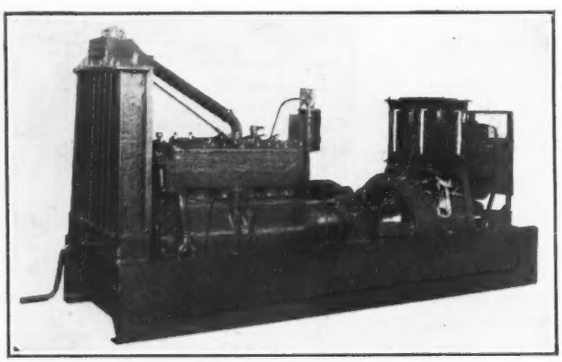
Readers should bear in mind that the Seventh Annual Exposition of Power and Mechanical Engineering will be held next December at the Grand Central Palace in New York. It will coincide with the annual convention of the American Society of Mechanical Engineers. The exposition will be the thoroughly rounded exhibit of all kinds of mechanical and engineering equipment that it has been in the past.

Shop Equipment

The modern way of painting is with a spray gun. A new gun (Type *EF*) for this purpose has recently been introduced by the Alexander Milburn Company, of Baltimore. It is provided with a dial which permits the operator to obtain any desired spray instantly without first making tests.

The Equipment Review

The steady progress of welding in steel construction is evidenced by the list of 85 welded structures published in the July issue of the *General Electric Review*. The list includes eight bridges, forty-three buildings, three cars, two cranes, six frames and towers, twelve ships and allied structures and eleven tanks. Prof. Frank T. McGibbon, who compiled the list, says it shows that the process of welding is no longer in the experimental stage and that it is so extensively used as to warrant the attention of all structural engineers and architects.



New 300-amp. welder driven by a gas engine

Welding Award — The American Welding Society, 33 West 39th St., has announced that the conditions under which the Samuel Wylie Miller medal will be awarded in the future have been revised. During the calendar year 1927 no paper of sufficient value to merit the award for that year was submitted. The board therefore has revised the conditions for awards as follows: The medal may be awarded annually for any meritorious achievement which in the judgment of the board of trustees has contributed conspicuously to the advancement of the art of gas fusion welding and cutting or the art of electric-arc fusion welding and cutting; also, the award for any calendar year shall be announced, and the medal, together with a suitable certificate, presented at an annual meeting or a fall meeting of the society.

Thus it is seen that the conditions governing the award of the medal have been broadened considerably. The award may now be made for a meritorious paper or for a conspicuous application of welding in industry, which has advanced the art. It may likewise be made for conspicuous service of a non-technical character which advances the welding art.

Gas-driven Welder—Among the welding equipment recently introduced is a new 300-amp. gasoline-engine-driven welder, known as Model S-1964, which has been introduced by the Lincoln Electric Company, of Cleveland, Ohio. The generator is rated at 300 amp. in accordance with the N.E.M.A. standards, has a current range of from 75 to 400 amp. for metallic electrode welding, and is direct-connected to a six-cylinder Buda Model HS-6 engine, operating at 1,500 r.p.m.

Shop Equipment

The Blacker Engineering Company, Grand Central Terminal, New York, has introduced a new model (Type B) of its blacksmith hammer, which retains the principles and design of the earlier model, but with certain refinements. It is a larger, heavier, and stronger ma-

BULLETINS

FLEXIBLE SHAFTS—Stow Manufacturing Company, Binghamton, N. Y. Bulletin 500. Four pages.

ELECTRICAL EQUIPMENT—The following bulletins have been received from General Electric Company:

GEA-994. Travel carriage for automatic arc welders.

GEA-869. Magnetic switch for alternating current motors.

GEA-961. Sheath-wire resistor units for cable reel motors.

GEA-981. Factory-built switchboards, 2,500 volts, 3 phase, 3 wire, 25-60 cycles.

GEA-979. Control circuit switches, a.c. or d.c., maximum 600 volts.

GEA-957. Mechanical-drive turbines, condensing or non-condensing up to 600 hp. and up to 6,000 r.p.m.

GEA-953. Steam turbines, condensing and extraction types, 2,000 to 7,500-kw. capacities.

GEA-973. Drum controllers for series, shunt or compound-wound d.c. motors.

GEA-751. Combination trolley wire suspension and guard board supports.

GEA-972. Pot-type electric furnaces for cyanide hardening.

GEA-941. Reciprocating air compressors, motor-driven, center-gear.

ARC WELDING—Lincoln Electric Company, Cleveland, Ohio. Bulletin 206, comparing two different types of equipment used in arc welding. These are the variable-voltage, single-operator, and the constant potential, multiple-operator.

NEWS OF THE WEEK

Summary

SUIT of farmers against United Verde and United Verde Ex. for damages resulting from smelter fumes was ended recently by the failure of the jury to agree on a verdict. This was the fourth action against the smelting companies started by the Verde Valley agriculturists. Page 69.

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Sir Edmund Davis is confident that Bwana M'Kubwa has every indication of proving a huge property. Plant at Rhodesia Broken Hill will be made more elastic to vary tonnage of different metals. Page 70.

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A possible extension of the Main Reef series of the Witwatersrand, from which one-half of the world's annual production of gold is obtained, was discovered in drilling for oil at the farm Gruisfontein. Page 69.

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Yankee Mines, in the American Fork district of Utah, is steadily increasing production. Completion of a new 100 ton mill is expected soon. Page 66.

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Western Merger, Gracie, and Murchie mines, in the Nevada City district, are developing promising orebodies. New mill of New England Consolidated is being used as a custom plant. Page 67.

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Mexican output of the major nonferrous metals for last six months is estimated to have increased slightly over the record for the previous half year.

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Confirmation is lacking of report that the Harriman interests have abandoned their manganese concession at Tchiatouri, granted by the Soviet government. Page 66.

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Shipments of June copper from the Michigan district were comparatively light. Only 8,652,000 lb. was moved by boat and a negligible quantity by rail. Page 68.

Klein or Drake Expected to Succeed Hoover as Secretary of Commerce

By PAUL WOOTON
Special Washington Correspondent

THE mining industry is much interested in the succession to the Secretaryship of Commerce. The man who will finish the unexpired term of Secretary Hoover will be in office during the period of the year when the budget is formulated. For that reason it is regarded as very important that the office go to one who is conversant with the needs of the industry, and particularly with the nation-wide demand for an expansion of the research work of the Bureau of Mines.

Fortunately, the two men being mentioned most prominently for the position are thoroughly conversant with the department's work and the desires of the mining industry. Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, is one of those mentioned for the place. He has been associated with the department in an important capacity throughout Secretary Hoover's tenure of office. Although he has been at the head of another bureau and has had nothing to do with the conduct of the Bureau of Mines, he is thoroughly aware of the feeling within the mining industry that the federal government is in a position to do much more than it has in the past to aid in the solution of fundamental problems which have an important bearing on the prosperity of a basic industry.

The other man being prominently mentioned for the post is J. Walter Drake. Mr. Drake was assistant Secretary of Commerce for five years. He resigned early this year to do preconvention work for Secretary Hoover in Michigan. Though Mr. Drake has had no mining experience, he has been highly successful as a business executive. During his service as assistant secretary and budget officer of the department, he became intimately familiar with the effort being made to secure increased appropriations for mining work. It is known that he is thoroughly in sympathy with that point of view.

Work on Dickens Concentrator Progresses Rapidly

Sullivan Plant Now Expected to Operate About Sept. 1—Constitution Will Be Reopened

MILL construction at Dickens Consolidated, on Moon Creek in the Coeur d'Alene district, is being pushed so as to have the new plant completed by Sept. 1. The mine, it is reported, will be ready to supply ore when the mill is finished. Chutes have been installed on the 400 and 500 levels, which were recently connected by a raise. Another raise of 100 ft. will be added and a new level started by the time the mill begins operations. The shaft is to be extended 200 ft. from the 500 level.

According to F. W. Bradley, president of the Bunker Hill & Sullivan Mining & Concentrating Company, the new electrolytic zinc plant of Sullivan Mining, which is owned jointly by the Bunker Hill and Hecla Mining companies, will go into operation on Sept. 1, and will be working at capacity by Dec. 31 next.

In addition to the Star property of Sullivan Mining, which is expected to be the chief source of zinc, the Sidney and Douglas mines will supply ore for the new plant. Many of the local operations which have hitherto been unprofitable because of the high zinc content in their ores, for which there has been no local market, may now be able to operate at a profit. This is particularly true of the mines along Pine Creek, where there is more zinc and less silver than in most Coeur d'Alene mines.

The Constitution mine, which is situated on Pine Creek, will be reopened. It was closed after a fire last fall. An extensive development program will probably be undertaken before resuming production. The shaft will be sunk at least 200 ft. deeper. Zinc production from the Constitution mine has heretofore been shipped to the Anaconda plant at Great Falls, Mont., but it will probably be sent to the Sullivan plant in the future.

Drifting in the Idora tunnel of the Yolanda Mining Company, on Sunset Peak, in the same district, has shown high-grade galena ore, according to a recent report. The drifting was started 1,800 ft. from the portal of the tunnel, and the strike was made after about 20 ft. of work had been done.

Production Increasing at Yankee Mines Property

STEADY shipments of silver-gold-copper ore are being made from the property of the Yankee Mines Company, situated 52 miles southeast of Salt Lake City, in Mary Ellen Gulch, American Fork Canyon. Four carloads had been shipped this season up to July 5, when two more were in the ore bins awaiting shipment. Settlement for the first car was made on the basis of 1.815 oz. of gold, 10.1 oz. of silver, and 4.13 per cent copper to the ton. Development of the property is being pushed, and extensive plans are under way for increasing production.

Construction of a new mill will be completed July 15. When in operation, this plant will treat 100 tons of ore daily, and should yield a ton of concentrates, averaging 10 to 20 oz. of silver, 2 oz. of gold, and 7 to 8 per cent copper, for every four tons of ore milled. Equipment in the mill includes a Cedar Rapids crusher, 16x24-in. rolls, two Harz type jigs, and two Deister Overstrom tables.

Underground operations are conducted through a 2,000-ft. tunnel, known as the main, or Holden, tunnel. An 80-ft. inclined raise, driven off the tunnel level at a point 1,200 ft. from the portal, leads to the present source of ore. At the top of this raise, 65 ft. vertically above the tunnel, a stope 22 ft. high and 20 ft. wide has been opened in ore. The chalcopyrite deposit is a replacement in limestone, and has been proved by raises for a distance of 150 ft. along the strike. A crew of ten men is employed at the property, operations being under the direction of G. E. Adams.

Property and surface plant of the Yankee Mines Company in American Fork Canyon, Utah

Ore and concentrates from the property, which is situated in rugged territory at an elevation of over 9,000 ft., are hauled by teams to American Fork, and there loaded into railroad cars for transport over the Union Pacific to the Midvale, Utah, smelter of the U. S. Smelting, Refining & Mining Company.

Officers and directors of the company, all of whom reside in Salt Lake City, are: Mrs. A. C. Ferlin, president; G. E. Adams, vice-president; R. W. Groo, secretary; Dr. F. M. McHugh, treasurer; and Dr. W. E. Hunter.

Prospecting Work at Bwana M'Kubwa Shows Four Miles of Ore

PROSPECTING at the N'Kana property of Bwana M'Kubwa Copper Mining in Northern Rhodesia has given evidence that the ore deposit is four or five miles long, according to the first quarterly report of the company. The N'Kana is one of three synclinal ore deposits now being actively developed in Northern Rhodesia. Results obtained at the first eight holes drilled at N'Kana show ore ranging between 3.72 and 5.82 per cent copper and varying from 15 to 37 ft. in width. Approximately one mile of drifting has been done at a depth of 100 ft., where the width and grade have been determined by several crosscuts.

In addition to the eight holes for which results were given, five more holes are being put down. The nature of the ore in the drill holes cannot be stated definitely, as the data were omitted from the report. However, below a vertical depth of 200 to 250 ft., the synclinal deposits are generally found to change to sulphides, the mineral occurring almost wholly in the form of chalcocite.

Report That Harriman Will Give Up Russian Manganese Concession Not Confirmed

Confirmation is lacking of the report which appeared in the daily press of July 4 and 5 that the Harriman interests had given up their manganese concession, granted by the Russian Soviet, in the Republic of Georgia. In these reports it was stated that the Soviet government would repay the capital expenditures made by the Harriman interests, amounting in all to about $3,500,000. The concession is at Tchiatouri and was described by L. J. Buck, vice-president of William H. Müller & Company, in *Engineering and Mining Journal* of June 23.

Secretary Work Appoints Boulder Dam Commission

A REPORT on Boulder dam in which the public is certain to have confidence seems assured by the appointment by the Secretary of the Interior of a commission, comprised as follows: Major General William L. Seibert, U. S. Army, retired; D. W. Mead, professor of hydraulic engineering at the University of Wisconsin; Robert Ridgeway, former president of the American Society of Civil Engineers; Charles P. Berkey, professor of geology at Columbia University; and W. J. Mead, a geologist on the staff of the University of Wisconsin. This commission, under a joint resolution adopted at the last session of Congress, is to examine the proposed site of the dam, review the plans and estimates made therefor, and to report on "matters affecting the safety, the economic and engineering feasibility, and the adequacy of the proposed structure and incidental works."

Completion of this project should supply power at reasonable rates for mining operations in adjacent regions. As the site of the dam would be in northwestern Arizona and southeastern Nevada, it would not be very distant from operations in the Kingman, Verde, Las Vegas, Tonopah, and Ely districts.

Workings at Boston-Colby Mine Will Be Deepened

A new shaft will be sunk from the lower tunnel level of Boston Colby Copper Mining at Saltese, Mineral County, Mont. This work will be done by contractors. At present, the mine is developed by two tunnels and a 90-ft. shaft. It is believed that ore will be found below the water level, the three veins cut a short distance above that level by the lower tunnel having been leached. The principal vein, which varies from 4 to 10 ft. in width, shows copper ore, with a little gold and silver. The property is situated on the Chicago, Milwaukee & St. Paul Railroad.

National Silica Operating Near Lompoc, Calif.

The recent sale by the National Magnesia Manufacturing Company of its plant at Redwood City, Calif., to the Celite Products Company, mentioned in *Engineering and Mining Journal* of May 26, did not include the mines and plant owned by the former company, situated 4 miles from Lompoc, Calif. This property is now being operated by National Silica Products, for the production of diatomite, sold as "Dia-Sil."

Four Yukon Dredges Go Into Operation

FOUR of the five dredges that Yukon Consolidated Gold Mining had planned to operate this summer are already in operation. They are working at Granville and 17 Dominion, in the Klondyke valley above Bear Creek, Yukon Territory, and 2 Dominion in the Klondyke valley below Bear Creek. Three drills are employed in cold-water thawing and a fourth is being prepared.

At North Fork, the Yukon Consolidated Company has a crew making a new flume to provide additional water for power purposes. Hydraulic work is under way at Crofton and Lovett gulches, and a good volume of water is coming through the Twelve-mile ditch and across the Bear Creek syphon. The company has about 250 men employed in these various operations, which represent all of the Treadgold holdings.

Headframe at the Gracie mine in the Nevada City district

Several Gold Properties Are Active in Nevada City District

IN THE Nevada City area of California, several promising gold properties are now active. New England Consolidated Mines recently erected a 50-ton mill on its property. The mine, which was unwatered some time ago, has been temporarily shut down and the mill is being used as a custom and concentrate-treatment plant.

North of Nevada City, the Western Merger has installed a surface plant, unwatered its shaft, and sunk and additional 130 ft. to a depth of 400 ft. Milling operations have been started. A Dillon-Box hoist operated by a 22½-hp. motor serves the shaft. Compressor equipment consists of a 12x12 Gardner-Denver driven by a 50-hp. motor and a 230-cu.ft. Ingersoll-Rand belt driven by a 40-hp. motor. Milling equipment consists of a Wheeling crusher, a five-stamp battery; amalgamating plates; a cut-down Wilfley, Johnson vanner, and Diester table. About fifteen tons per day is crushed. A picking belt and Vezin sampler are also available. Underground a two-stage 250-g.p.m. Fairbanks-Morse centrifugal, operated by a 50-hp. motor, has been installed for drainage. A three-throw pump, 7½-hp. motor and a 4-in. Cornish pump with 10-hp. motor complete the drainage equipment. The mine is a prospect and is in the development stage.

The Gracie property, on the north slope of Banner ridge, southeast of Nevada City, is being unwatered by private interests. It is on the Orleans vein. An oreshoot has been found and a ten-stamp mill is being erected. The shaft is 200 ft. in depth.

East of Nevada City, the old Murchie property has been acquired by the American Foundation Company, which is represented as being privately owned by six individuals. A 680-ft. drain tunnel has been extended to the 1,150-ft. shaft at the 170 level, and the 400 level has been unwatered. There are two veins, the Big Blue and the Independence. The first named is said to have been mined out to a depth of 1,000 ft. The property was closed down in 1908. The present company has retimbered the three-compartment shaft from the 140 level to the surface, rebuilt the twenty-stamp mill, and constructed a gravity tram between the mill and shaft. An air lift was used in unwatering. It is planned to use both air lift and Byron Jackson sinking pump below the 400 level and a three-stage centrifugal between the 400 level and the drain tunnel. A Cornish pump is still in the shaft. Hoist and mill are driven by water power. V. M. Price, president of the company, stated that $200,000 had been spent on the property to date.

Two U. S. Mining Engineers Freed by Mexican Bandits

W. H. Mitchell and John H. Hooper, mining engineers at the Mezquital del Oro property of Pacific Mining, who were kidnapped by Mexican bandits on June 22, have been returned to Guadalajara safely, according to a report from Mexico City. Both declared that they had been well treated by their captors. It is said that a ransom was paid for their release, although the amount paid has not been disclosed. The bandits demanded 18,000 pesos.

Mineral Separation Sues Calaveras Copper

A suit for $51,539 was filed on June 28, 1928, against the Calaveras Copper Company, of Copperopolis, Calif., by the Mineral Separation North American Corporation for unauthorized use of its flotation process since 1918.

Hope Metals Preparing For Extraction Operations

FOLLOWING a systematic development campaign pursued during the last five years, the Hope Metals Company plans to begin active mining and milling operations on Oct. 1 at its silver-lead property situated eleven miles from Winkleman, Ariz., according to Arthur L. Flagg, consulting engineer of Phoenix, Ariz., and vice-president of the company.

A 50-ton flotation mill is being erected, and two miles west of the property the Collins Western Corporation is constructing for the company a steam-electric power plant on the Gila River. A crew of 50 men is now employed, and, when extraction operations are started, ten rock drills will be worked.

Equipment in the mill, most of which has been supplied by the Eastern Iron & Metal Company, of Salt Lake City, includes a No. 4 Gates gyratory crusher, a 6 ft. x 22 in. Hardinge ball mill, a duplex Dorr classifier, and two K &. K. flotation machines. The power plant will house a 340-hp. Skinner uniflow engine and a 312-kva. General Electric 2,300-volt generator. A 625-cu.ft. Sullivan compressor is also being installed on the property.

Holdings of Hope Metals consist of a consolidation of properties comprising 600 acres that were acquired by the company in 1923. Underground workings, which total more than 7,500 ft., include seven tunnels and a long crosscut that intersects the various productive veins. Past production from the ground, dating back to the 'nineties, is estimated to have been in excess of $300,000.

Officers of the company are: S. Foster Hunt, president; Arthur L. Flagg, vice-president; and Gerald A. Cooper, secretary and treasurer. Offices of the company are situated at Providence, R. I.

Yankee Girl Plans 200-Ton Flotation-Cyanide Plant

PLANS for the construction of a flotation-cyanide plant of 200 tons' daily capacity are being drawn up by the engineers of Yankee Girl, Ltd. which owns a silver-gold-lead-zinc mine at Ymir, B. C. Work on the plant will be started within the next six weeks. Arthur Lakes, consulting geologist for the company, estimates that a reserve of 269,000 tons of ore, averaging $14.17 per ton, has been developed. This value is based on the 62,000 tons that have been shipped to the Trail smelter from the Yankee Girl.

At the adjoining Enterprise Mines, it has been decided that, instead of developing its own water power to operate the mines, it will be more profitable to spend the money on development and equipment of the mines and to buy power from the West Kootenay Power & Light Company, which has offered favorable terms and undertaken to erect a transmission line to the mine. The power company expects to be able to deliver power in two months.

Big Jim Mines Purchases Group of Adjoining Claims

New Cornelia to Increase Water Supply to 6,000 G.P.M.—Continue Shaft Sinking at Eighty-Five Mine

PURCHASE of the Hardshell group of silver-lead-zinc claims at Harshaw, near Patagonia, Santa Cruz County, Ariz., by Big Jim Mines has been announced by E. T. Cusick, attorney for Richardson Real Estate, Mining & Commercial Corporation, former owners. The price for the group of 23 claims was $225,000. The Richardson company also owns the Flux mine.

Location of the properties was made in 1880 and they were purchased soon after by the late Col. R. R. Richardson. They were leased out to various companies at different times, but eventually reverted to Colonel Richardson, who formed a company with a capitalization of $400,000.

Development of the Hardshell group is by two shafts, one incline and one vertical. About 4,000 ft. of workings have been driven. The ore occurs in a shear-zone lode of rhyolite, with the silver and lead predominating. The mines of the Big Jim company adjoin the Hardshell group, and are equipped with a modern 75-ton flotation mill.

Plans to increase the water supply of New Cornelia Copper at its properties at Ajo, Ariz., have been announced from the Warren office of Calumet & Arizona, which controls New Cornelia. The water supply at Ajo now comes from two 650-ft. shafts and some tunnels which radiate from them. To increase the flow of water, additional tunneling will be done. A new electrical pump, motors, transformers, and a compressor have been ordered for the work. The new installation will bring the number of the pumps up to five, with a total capacity of 6,200 g.p.m. The work will cost about $200,000.

Work of sinking the 1,750-ft. two-compartment shaft at Calumet & Arizona's Eighty-Five mine near Valedon, N. M., is well under way. A new compressor has been purchased for the project. A boarding house, bunk house, and employees' residences are being built. The new shaft is 4,500 ft. southwest of the main shaft and is being sunk for exploratory purposes.

Idaho Bureau of Mines Has Extensive Summer Program

EIGHT projects constitute the 1928 summer field program of the Idaho Bureau of Mines and Geology. The investigations touch all parts of the state. Dr. F. B. Laney, professor of geology at the University of Idaho school of mines, is completing his study on the geology and ore deposits of the Seven Devils area in Adams County. This study has been under way since 1919, but within the last year interest in a possible railroad down the Snake River through the Seven Devils country has concentrated unusual attention in the mineral possibilities of the region. Virgil R. D. Kirkham will head a party studying gas escapement in southwestern Idaho and its bearing on petroleum possibilities in the region. Alfred L. Anderson is studying the significance of recent silver-lead discoveries reported from areas south of the St. Joe River in Benewah and Shoshone counties. Two of the projects are in co-operation with the U. S. Geological Survey. Clyde P. Ross will head a party to prepare a geologic map of the Bayhorse quadrangle, in Custer County, as well as to make a study of the ore deposits of the area. A co-operative study of underground water in parts of the Snake River valley will be made.

In co-operation with the U. S. Bureau of Mines, the Idaho bureau is continuing its study of the complex ore problems of the Coeur d'Alene district. This project is being directed by A. W. Fahrenwald, who is dividing his time between Idaho and Michigan. Clarence Thom is Mr. Fahrenwald's resident assistant in Idaho. Ernest W. Ellis is continuing the survey of Idaho hot springs started several years ago by Dr. Francis A. Thomson, retiring director of the Idaho bureau.

Unity Gold Mines Replaces Stamps With Ball Mill

A TEN-STAMP battery in the mill of the Unity Gold Mines Company, situated at Warren, Idaho, is being replaced with a 4x3-ft. Marcy ball mill, operating in closed circuit with a simplex Dorr classifier. This equipment, which was supplied by the Eastern Iron & Steel Company, of Salt Lake City, will be employed in conjunction with amalgamation and flotation treatment of the gold-quartz ore mined at the property. Capacity of the mill, following the remodeling in progress, will be 25 tons a day, and extraction is expected to be considerably increased.

At present a crew of twelve men is employed, and six rock drills are being worked. Mechanical equipment on the property includes a 600-cu.ft. Sullivan and a 300-cu.ft. Chicago Pneumatic compressor. Power is obtained over a 9-mile transmission line from the company's 300-hp. hydro-electric plant situated on the South Fork of the Salmon River.

Operations at Unity Gold Mines are in charge of Granville T. Eyman, manager of the company.

Wigwam Is Making Electrical Survey

An extensive electrical prospecting survey is being undertaken on the property of Wigwam Mining, in the Revelstoke district of British Columbia, under the direction of J. H. Brown, of Toronto, by Schlumberger Electrical Prospecting Methods. W. T. Dumbleton is manager of the property, which carries silver-lead ore. Results of the prospecting to date are said to be both interesting and encouraging.

June Copper Shipments Light From Michigan District

Tunnel Driving Proceeds at Carp Lake Property—Champion Copper Using Magnetic Needle

JUNE shipments of copper from the Michigan district were comparatively light, only 8,652,000 lb. moving by boat. Of this amount, 6,072,000 was shipped by Calumet & Hecla Consolidated from Torch Lake and 2,580,000 lb. was moved from the Houghton docks, representing Copper-Range, Mohawk, and Isle Royale metal. Shipments by rail during the month were negligible, as is usual at this season.

Champion Copper has considerable work yet to do in its magnetic dip-needle survey in the 5,000-acre tract to the north and west of the Champion mine that it is to explore for copper-bearing lodes. Work now in progress will indicate the trend of the veins and should be particularly helpful in connection with faults. The state geological survey also is interested in magnetic dip-needle work in the district. Last year, the survey made some valuable records in the north end of the district, and this year the work is proceeding in Copper Range and other lands to the south.

At the Carp Lake property, in the Porcupine Mountains in Ontonagon County, one of the new explorations in the Michigan copper district, a tunnel now being driven should intersect copper-bearing formation at a depth of between 400 and 500 ft. There are surface outcroppings of copper, and it is the present purpose to determine whether these values extend to depth. An examination of the property revealed interesting geological conditions. To within 100 ft. of the top of the mountains, the formation is sandstone, topped with a flow of trap rock. The upper 30 ft. of sandstone under the trap rock is impregnated with native copper, forming the deposit. The copper occurs principally in the upper 6 ft. and lower 10 ft., with 15 ft. or so of barren sandstone between.

El Fuerte Will Increase Output From Sinaloa Mines

EL FUERTE Mining Company, which was recently organized in Delaware by Los Angeles interest to take over the holdings of El Fuerte Mining & Smelting, Choix Consolidated, and Los Platanos, all of which own properties in Sinaloa, is preparing to increase production. According to the terms of the merger, by which 10,000,000 shares of El Fuerte Mining were distributed proportionately to the stockholders of the three original companies, the new company owns nineteen titled and producing mines, a blast furnace with a capacity of 125 tons daily, and a 500-acre townsite and buildings. The ores at the various properties carry gold, silver, copper, and lead.

New Highway Will Aid Operations at Lone Pine

THE Elk City highway, being constructed along the south fork of the Clearwater River in Idaho County, Idaho, is expected to facilitate economical production at the Lone Pine mine, located in the Ten Mile district. The property consists of four patented and four unpatented claims, owned and operated by F. O. Müller, of Clarkston, Wash. The ore is free-milling gold and extraction is accomplished by amalgamation and on blankets. There is a small two-stamp, triple-discharge mill on the ground, which treats about eight tons of ore daily. It is driven by water power from a 220-ft. head.

The vein which is being mined has an average width of about 3 ft. and has been opened up for a distance of 120 ft. The accompanying illustration shows the track connecting the mill with the ore bins at the mouth of the mine.

Jury Fails to Agree in Arizona Smelter Suit

No Verdict Given in Action of Verde Valley Farmers Against United Verde and United Verde Ex.

THE JURY in the smoke case which was recently tried in the superior court of Yavapai County, Ariz., was unable to agree after considering the case for 21 hours, and was discharged. A group of Verde Valley farmers, headed by Jackson and Van Deren, claimed damages from the United Verde and United Verde Extension companies, both of which operate smelters, at Clarkdale and at Clemenceau, respectively.

The history of the litigation shows that the farmers had great difficulty in proving their claims against the defense of the mining companies that the conditions alleged to be the result of smoke damage were due to soil conditions and methods of irrigation and cultivation, as well as to plant pests and diseases.

This suit is the fourth that has been brought in the last ten years. The first series of cases filed were never brought to trial. The second series culminated in the Biles-Wells case, which was tried in 1921. After six weeks of trial the jury reported a disagreement, but was urged, because of the length and expense of the trial, to make further effort to agree. They then reported a verdict for the farmers of $1 and costs, clearly a compromise to permit them to be discharged. When this case was tried the smelters were closed down, but crop conditions that year were much the same as when the smelters were operating at normal capacity.

The third series of suits resulted in the trial of the Jordan case in the federal court before Judge Bourquin. This issue was rushed through in one week, and resulted in a verdict of nearly $5,000 against each company. The Jackson-Van Deren case, which has just been concluded, went into the fourth week before being submitted to the jury.

In each of the cases tried the defense of the companies has been that specific injuries to crops and trees have resulted from other causes than smoke from the smelter. The companies have exhibited plants marked by smoke which have been subjected to much heavier fumes in experiments than the field crops could possibly have experienced, but which have not had their growth materially reduced by such treatment. A farmer employed by the companies during the years 1927-1928, the period covered by the case just tried, operated two farms, the Hopkins ranch and the Taylor ranch, selected because they were more exposed to smelter smoke than any other properties in the valley. This farmer raised the best crops produced on any of the farms in the valley, according to the testimony presented.

Discover Possible Extension of the Rand Main Reef

AT DEVON, 25 miles east of Springs, on the Witwatersrand, indications of a possible extension of the Main Reef series, from which more than half of the world's annual gold production is obtained, have been found. J. Allan Woodburn, reporting on the No. 2 borehole on the farm Gruisfontein, where the Devon Petroleum Company has been boring for oil, said: "This is distinctly Witwatersrand formation. . . . There is every reason to believe that this formation overlies the Main Reef series, and only deeper drilling, until a more definite mark is reached, will determine at what depth the Main Reef series will be encountered."

At a depth of 846 ft. the borehole passed through the Dwyka conglomerate, which is the base of the Karoo formation, and drilled into the Witwatersrand quartzites, interbedded with diabase. The dolorite formation, which overlies a certain portion of the East Rand, is absent. At 1,059 ft. the borehole passed into hard blue shale, with small ribs of quartzite showing pyrites to 1,074 ft.

Four Groups of Cripple Creek Mines Are Purchased

J. A. F. Durocher Stone, of New York, has purchased four different mine groups in the Cripple Creek district, and plans to consolidate them into one company, to be known as Colorado Mining Trust, Inc. The mines are all old gold producers which were closed when high-grade ore was exhausted. They are the Anchoria-Leland and the Conundrum, which were sold by Irving Howbert, of Colorado Springs, and the Midget and the Bonanza-King, which were purchased from J. F. W. Doepke, of St. Louis.

The new company which will be formed will have a capital of $10,000,000. J. T. Milliken, mining engineer of Colorado Springs, will be in charge of the development work. A force is to be put to work to unwater the mines immediately, according to Mr. Stone.

New Feldspar Deposit Found in New Hampshire

A deposit of feldspar, said to be 100,000 sq.ft. in area, has been found by Prof. Charles E. Locke, of the Massachusetts Institute of Technology, on a farm in Alstead, N. H., near the holdings of the Golding-Keene Company. The new deposit will not be operated at present by Golding-Keene, which has bought the farm, because its present operations are satisfying demands. It is said that there is enough feldspar in the new deposit to meet the needs of the American ceramic industry for a generation. At present, the New Hampshire deposits furnish about one-seventh of the annual production of the United States.

London Letter

By W. A. Doman
Special Correspondent

Sir Edmund Davis Confident of Future of Rhodesian Copper Mines

London, June 26, 1928.—Sir Edmund Davis has returned from South Africa full of enthusiasm in regard to the Rhodesian copper mines in which he is interested—but when was he not enthusiastic? Though Bwana M'Kubwa has not yet fulfilled expectations, Sir Edmund says it has every indication of proving a huge property. Because some time ago shareholders showed dissatisfaction, arrangements have been made to buy up all small lots of shares, and by so doing the number of shareholders has been reduced by 158. Referring to Rhodesia Broken Hill, of which he is chairman and managing director, Sir Edmund spoke of increased capital expenditure to give a certain amount of elasticity to the plant, so that it should be in a position to vary the tonnages of different metals produced in accordance with the profit or loss which might be realized.

Anglo-Oriental Mining Corporation, Ltd., has issued a bulletin—to be published monthly—dealing with the prospects and statistics of the tin industry. Current statistics of stocks are not believed by some, and despite the low price of the metal it is said that "production has not overtaken demand." The fall in price is eliminating the small Chinese producers, who have neither the richest areas nor the capital to win tin on a large scale. As these Chinese mines produce more than 30,000 tons yearly, the importance of price to their owners is evident. The idea of the Anglo-Oriental directors, as mentioned in a previous letter, is consolidation and regrouping on a large scale to avoid waste ensuing from the use of inadequate plants, and to enable stocks of tin to be built up safely.

The new smelting works of the Penpoll Tin Company are said to be the most efficient buildings of their kind in the world. They are capable of dealing with all the tin ore that enters the country, and of smelting half of the entire world tin production. Every particle of tin is retrieved from the fumes, and all production of tin is "sold before it is cold." To show the trend of events, I may mention that a group of Malayan companies with a capital aggregating £2,000,000 has registered particulars at Somerset House. The price of tin has fallen to £207, which bears out a statement in an earlier letter that it was to be allowed to reach the neighborhood of £200 for various reasons, when it would be raised and "stabilized." The shares of Eastern dredging companies are being bought by "good people."

The diamond market is a little disturbed at news recently received concerning the diamond finds in Tanganyika territory. H. S. Harger, who has had a good deal of experience in diamond mining, is supervising operations over an area of approximately 25 square miles in the Shinyanga diamond belt, and a new company is to be formed called Central Diamond Mines of Tanganyika, Ltd. It is reported that one exclusive prospecting area of one square mile covers diamondiferous ground on which three kimberlite occurrences have been discovered, and from 1,200 loads washed, 250 carats of diamonds were recovered, only one small pan being employed.

Mexico City Letter

By W. L. Vail
Special Correspondent

Estimate Increase in Output of Non-Ferrous Metals for First Half of 1928

Mexico City, July 3, 1928.—It is estimated that the Mexican output of copper, lead, silver, and zinc during the first six months of 1928 will show a slight increase over the record for the previous six months. A marked increase in the production of quicksilver is expected. The unusually favorable price for the metal has stimulated production and exploration in several states, and many mines, idle for years, have been put on a producing basis again. An increase is also expected in gold production as a result of the renewal of placer mining on an extensive scale in several of the northern provinces of the country.

The latest interest in placer ground appears to be in the old field of Llanos de Oro, between Santa Ana and Altar, in the Altar district, State of Sonora. These placers are extensive, and numerous attempts have been made to work them profitably, but none met with success. A group recently organized proposes to secure water for operations from the Ocuca ranch, 21 miles from Santa Ana, where it is claimed that it can be obtained in abundance.

In addition to the expected increase in production, general mining conditions throughout the country are quite satisfactory. The fact that the presidential election, resulting in the selection of General Obregon, went off peacefully is regarded as a favorable omen. Very little labor trouble is reported, and most of the larger camps are producing regularly. It is not considered likely that the proposed labor law will be brought before any of the special sessions of the national legislature, which means that it will probably be handled soon after President Obregon is inaugurated on Dec. 1.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Noranda Is Chief Topic in Mining Circles as Stock Soars in Price

Toronto, July 7, 1928.—Noranda Mines, in which speculation has been enormous for the last week, closed at $54\frac{7}{8}$ after reaching a high of $64. About three months ago, it was quoted at about $17 a share. The valuation of $55 a share gives a total value to the mine of about $115,000,000. This tremendous rise is credited almost entirely to the discoveries on the 975 level, and a rumored conflict between Canadian and American interests for control of the stock.

The latest reports from the mine indicate 200 ft. of ore at the 975 level in the "H" orebody. In addition, a drive to the north on the 850 level, where a station was recently cut, is said to show 60 ft. of ore. The cutting of a station on the 725 level is now being pushed. Reports from the company's smelter state that it handled an average of about 750 tons a day during June.

Northern Canada Mining was formed on July 5, by the stockholders of Beaver Consolidated. In addition to changing the name, the capital was increased from 2,000,000 shares of $1 par to 5,000,000 shares of no par. The company in the future will broaden its scope by entering the investment field. At present it holds about 1,700,000 shares of the Kirkland Lake Gold Company as its only asset. These shares have a value of about $2,200,000 at present quotations. William Sixt, mine manager of the mine at Kirkland Lake, said that developments at the property recently have been centered about the 2,600 and 2,725 levels. On the latter level, two orebodies have been found to the east which, it is expected, should apex between the 2,500 and 2,600 levels. The directors of the company recently voted to deepen the shaft workings to 6,000 ft. It is said that Teck-Hughes is considering a similar move.

At the McIntyre-Porcupine mine, in the Porcupine district, developments on the 3,500 level have shown 20 ft. of ore, reported to average about $10. McIntyre is producing from deeper levels than any other Canadian mine, at present, as extraction is being effected from the 3,375 level. Mill expansion will depend almost entirely on results obtained in these levels.

Clericy Consolidated Mines has confirmed reports of discovery of high-grade copper at the property in the township of Frechette, 60 miles from Sudbury in northern Ontario. The official report states that the discovery has been traced along the strike for 50 ft. Further exploration has been discontinued because of swampy ground.

Island Falls Site to Be Flooded on July 15

OWNERS of land in the neighborhood of Island Falls, Saskatchewan, have been notified to enter claims for their land, as the region will be flooded on July 15 to provide power for the Flin Flon mine of Hudson Bay M. & S. For the present, it is reported, the company will develop about 50,000 hp.

Electric power derived from the Island Falls development, on the Churchill River, 55 miles distant from the Flin Flon mine, will be used for a mine plant, flotation mill with cyanide annex, copper smelter, and electrolytic zinc plant. A considerable part of the power will also probably be used for electric power shovels, working in an open pit, with which one-third of the 3,000 tons' daily production which it is planned to handle, will be mined. It has been made a condition by the Saskatchewan provincial government that one-sixth of the power developed at Island Falls be reserved for public use.

Kennedy Mining Orders New Headframe for Jackson Mine

KENNEDY Mining & Milling of Jackson, Calif., has let a contract to the Moore Shipbuilding Company, of Oakland, for the construction of a 135-ft. steel headframe to replace the present wooden structure so long a landmark on the Mother Lode. The Kennedy shaft, 4,766 ft., is the deepest in any gold mine in the United States. Its vertical shaft, when the headframe is completed, will be one of the best equipped in the state. The installation of the headframe is part of a general program of rehabilitation of the property. Some time ago the hoist was changed from steam to motor drive and compressor equipment modernized. A tube mill was added to the stamp mill.

It is generally understood that the lower levels of the Kennedy are producing a good grade of ore. Plans are under consideration for opening out deeper levels, but as the present hoisting equipment is close to its maximum depth limit, an underground incline, transfer pockets, and hoisting facilities will be necessary.

As a preliminary to a thorough examination, the Greenman shaft of the Mayflower property, Nevada County, has been unwatered to the 300 level. The property is on Canada Hill, Nevada City district, and was formerly operated by Mayflower Mines, Consolidated.

Five stamps will be added to the mill equipment of Kate Hardy Mining which operates the Brush Creek mine west of Forest, Sierra County. W. Lichenberg is superintendent.

Societies, Addresses, Reports

More Than 200 Will Attend Liverpool Meeting of the Institute of Metals

ALREADY more than 200 members of the British Institute of Metals have indicated their intention of taking part in the Liverpool meeting of the Institute. Many of these will come from foreign countries. The papers to be presented at the meeting include a series dealing with the die-casting of alloys, as well as the eighth report of the Corrosion Research Committee. A discussion of corrosion problems will form a feature of the meeting, which should be particularly appropriate in a maritime centre such as Liverpool. The meeting will be held on Sept. 4-7, and full details may be obtained from G. Shaw Scott, Secretary of the Institute of Metals, 14 Members' Mansions, Westminster, London, S. W. 1, England.

U. S. Government to Appoint Junior Mining Engineer

The U. S. Civil Service Commission will receive applications for appointment as junior mining engineer in the government service at $2,000 per year until Aug. 7. The duties will include routine testing, inspection of engineering material, drawing up plans for minor projects, preparing specifications for engineering material or apparatus for field work, making computations, preparing maps, and assisting in the conduct of experimental research tests. Competitors will be rated on general physics, mathematics, general engineering, and mining engineering.

Joint Meeting to Be Held at Los Angeles Sept. 10-13

A joint meeting, in which the Western Division of the American Mining Congress, western sections of the A.I.M.E., and the California Development Association will participate, is to be held Sept. 10-13 at Los Angeles. The Arizona chapter of the congress will hold its regular quarterly meeting during the same period.

Arrangements for the joint meeting are being completed by J. F. Callbreath, secretary of the American Mining Congress, who is now on the Pacific Coast for that purpose.

Geological Survey to Exhibit at Seville Exposition

THE Geological Survey will make a mineral exhibit at an international exposition at Seville, Spain, beginning March 15, 1929. C. G. Abbott, Secretary of the Smithsonian Institution, favors the construction in the United States of a $7,500,000 industrial museum which will illustrate the development of the mining and other industries of this country. If the project is not authorized by Congress, it has been suggested that it may be done privately.

Human Relations in Industry Will Be Studied

THE eleventh annual conference on "Human Relations in Industry" will be held at Lake George, New York, on Aug. 29-Sept. 2, under the auspices of the Y.M.C.A. Between six and seven hundred leaders of industry are expected at the conference, of which Arthur H. Young, of New York City, is chairman. Among the topics for discussion are American Industry and World Problems; Safeguarding the Workers' Incomes; the Length, Breadth, and Thickness of Retirement Plans; Labor's Viewpoint on Vital Issues; and the Management's Problems and the One Way Out. For further details, write Fred H. Rindge, Jr., Industrial Department, National Council of Y.M.C.A., 347 Madison Ave., New York City.

A.A.E. Votes Resolution Thanking Hoover for Message

AT THE annual meeting of the American Association of Engineers, at El Paso, Tex., the following resolution was passed, thanking Secretary Hoover of the Department of Commerce for his interest in the association:

"Whereas, The Hon. Herbert Hoover, Secretary of Commerce of the United States, has telegraphed to L. M. Lawson an expression of his appreciation of the work that the American Association of Engineers has done in inducing engineers to engage in public service, in stimulating better utilization of our natural resources and the elimination of waste, and in advancing the standing of engineers as a group; and,

"Whereas, Secretary Hoover, has, by his great professional accomplishments and his very energetic, effective, and self-sacrificing service to humanity and his country, been himself a striking example of the application of the ideals advocated by the association;

"Be it resolved, by the members and delegates of the American Association of Engineers in convention assembled, that they hereby express their gratitude to Secretary Hoover for his message, evidencing as it does his interest in the association, and their hope that the splendid talents of this great engineer will long be recognized and fully utilized to the further benefit of his fellow countrymen and to the advancement of the engineering profession in public esteem."

BOOK REVIEWS

Research and Plant Control

MECHANOCHEMISTRY AND THE COLLOID MILL. By Pierce M. Travis. New York. Chemical Catalog Company. Pages 191, illustrated. Price $4.

MR. TRAVIS has written a compact treatise that should be of immense help to technical students and plant operators. Unlike so many other contributors to the literature of the subject, he does not assume that the reader possesses an intimate knowledge of what is usually termed colloidal chemistry. By a concise, yet comprehensive, treatment of the subject he insures a continuity of interest. Each section is prefaced by just sufficient definition and explanation to clarify the subject and assist in the interpretation of the book as a valuable aid, from the theoretical as well as from the practical standpoint.

No argument is needed to emphasize the vast and growing importance of a knowledge of the influence of physical chemistry in almost every phase of technical investigation work and operating control. Mr. Travis uses the term "mechanochemistry" to cover dispersion or deflocculation by mechanical means, with particular reference to the production of colloidal dispersions thus. A substance, in the colloidal state—it is not desirable to speak of a colloid—comprises finely divided particles in suspension. Almost every substance that exists as a solid can be transformed into a crystalloidal or into a colloidal solution, the particular state depending in some instances on the nature of the solvent used. Mr. Travis makes it clear that no well-marked line of demarcation exists between true solutions and colloidal solutions, or between colloidal solutions and suspensions.

A chapter on the elementary structure of matter is followed by a discussion on viscosity and plasticity. The all-important subject of adsorption is given adequate treatment; this chapter is most interesting, and should prove useful to the technician who, by reason of the complex treatment of the subject by most authors, has neglected to give the matter the attention it deserves.

Metallurgists will appreciate the concise statement in Chapter VII, on hydrogen-ion concentration and its importance in colloidal dispersion. The general acceptance of this adequate method of expressing acidity and alkalinity is inevitable as soon as its features are better understood. A thorough grasp of the theory of emulsions and emulsification must form the basis of a study of the flotation process, in which, as the author remarks, practice is far ahead of theory.

The final chapters of the book deal with what is known as the colloid mill and some of its applications. Contrary to popular impression, especially among those not versed in recent advances in physical chemistry, the machine cannot transform anything into the colloidal state, or break it down to molecular proportions. It accomplishes no grinding action. The name "colloid mill" is a complete misnomer. It is merely a deflocculator. The author feels that it is too late to make a change in nomenclature; but this should be practicable if agreement were reached as to a preferable term. A.W.A.

"Manuel D'Exploitation Des Gisements Aurifères Au Congo Belge"

"GUIDE FOR THE EXPLOITATION OF THE GOLD DEPOSITS IN THE BELGIAN CONGO." By R. Monti and R. Anthoine. Maison Desoer, S.A., 21 Rue Ste.-Veronique, Liége, Belgium. Pages 186.

THE success achieved by the administrative and technical services of the Société des Mines d'Or de Kilo-Moto has prompted that company to bring out this manual as a practical guide for its younger employees. This follows the precedent set when the same staffs issued, three years ago, a similar guide for prospecting "Guide Pratique pour la Conduite des Prospections Aurifères dans la Région Minière de Kilo-Moto.")

This new manual is intended to be a fairly complete mentor for the engineer charged with establishing a camp and setting in motion the work of exploitation on a Congo placer operation. With this in view it starts at the beginning and outlines the general rules to be followed in choosing the site for a camp, and the effect that different factors, such as topography and vegetation, will have in the choice of the type of camp to be erected.

The organization of the work is then detailed under the heads of Preparatory Work, Exploitation Work, and Accessory Work. These sections give the general rules to be followed in the orientation of the labor in the camp and "on the job." Following this come the sections devoted to describing in detail the construction of dams, flumes, sluices, and ditches. The necessary rules and formulas are given, so that the engineer is at no time "in the dark" as to what he is doing, even though he may have forgotten some of his textbook knowledge. In the same way he is led through the actual exploitation work by detailed descriptions of how the apparatus and appliances are constructed and how operated, and how to dispose of his men and material to the best advantage. Moreover, he is given an idea of what should constitute a satisfactory day's work on the part of the different laborers under his supervision, and is directed how to compute the bonuses that should be given in recognition of surpassing these marks.

Similar chapters are devoted to the accessory work required in and about the camp and to the administrative portions of his duties, including the "paper work." A short section deals with the procedure followed in exploiting of vein deposits.

Although this book is primarily meant for the engineer dealing with the peculiar problems found in the course of exploiting placers with native labor, there is much material therein of more general application. Any young engineer charged with putting a placer proposition in operation would find in this volume a great deal of information that would prevent much groping in the dark, were he comparatively inexperienced in that particular phase of mining. The book is sufficiently explicit and detailed to preclude the possibility of error on the part of the engineer following it, at least under the conditions envisaged by its authors.

SHERWIN F. KELLY.

COAL STORAGE—A. J. Hoskin is the author of a 54-page paper entitled "A Study of Spontaneous Combustion in Storage Coal," published as the April bulletin (No. 30) of Purdue University, Lafayette, Ind. Professor Hoskin has endeavored to evaluate the findings of practical and scientific men and to present such of their conclusions as appear worth while. He does not attempt to cover all practices in coal storage. No effort has been made to standardize coal-storage practice, he says. Operators have found their differing practices satisfactory, and if fires have occurred they have been attributed to extenuating conditions. Moreover, scientific investigators have not been unanimous in their advice. The bulletin concludes with a bibliography of some 90 items.

COPPER LEACHING—Two reports on the Murdoch copper leaching process are presented in Bulletin No. 3 issued by the School of Mines of Western Australia, at Kalgoorlie. The process, which is patented in Australia, claims to recover the copper from oxidized copper ores by leaching with a solution of calcium chloride, sodium chloride, and sulphurous acid, by which means the copper is converted to cuprous chloride, which dissolves in a sodium chloride solution and is precipitated therefrom as cuprous oxide by the addition of milk of lime.

BROMOCYANIDATION—Bulletin No. 3 of the School of Mines of Western Australia, at Kalgoorlie, also contains a preliminary report on the bromocyanidation of Kalgoorlie ores. One of the most serious items of cost in the treatment of Kalgoorlie ores as carried out in the dry-crushing all-roasting plants now in operation, the investigator says, is the cost of roasting the whole of the ore, although the proportion of sulphide minerals requiring roasting prior to cyanidation is comparatively small. Two modifications of present-day treatment practice are suggested by the researcher.

Personal Notes

FRANK L. SIZER, mining engineer, has returned to San Francisco after a short trip to Eastern states.

Colonel JACK LECKIE has been appointed manager of the Manitoba operations of Northern Aërial Minerals Exploration, Ltd.

H. Y. WALKER, vice-president of the American Smelting & Refining Company, is on a trip through the Western properties of the company.

GEORGE H. GARREY, who has been on geological examination work in Maricopa County, Ariz., for the last three weeks, has gone to Denver.

DONALD M. LIDDELL sailed for Europe on board the "France" on July 6, accompanied by his family. He will spend three months abroad.

WILLIAM HENRY HARRISON, consulting engineer of Washington, D. C., has returned to his headquarters there after a trip through the Tri-State district.

JAMES E. FISHER of Calumet, Mich., secretary-treasurer of Calumet & Arizona and New Cornelia Copper, has been named a member of the board of directors of both companies.

ARTHUR L. FLAGG, consulting engineer of Phoenix, Ariz., was in Salt Lake City last week in connection with the erection of a mill on the Hope Metals property near Winkelman, Ariz.

H. E. CLEMENT has resigned as general manager of the Porcupine Paymaster, in the Porcupine district of northern Ontario, a position which he had occupied for the last four years.

J. E. JEROME, formerly with the Britannia Mines, has joined the field staff of WALTER R. VIDLER at Sudbury, Ont. The headquarters of the firm have been transferred from Haileybury to Toronto.

GRANVILLE T. EYMAN, manager of the Unity Gold Mines Company, was in Salt Lake City last week. He is advising on the purchase of additional equipment for the mill of the company situated at Warren, Idaho.

IRVINE M. MARSHALL has been appointed superintendent of Central Manitoba Mines, which owns properties in the Long Lake district of Manitoba. Mr. Marshall is a graduate of Queens University, Kingston, Ont.

C. S. CORBETT, chief geologist of the Nederlansche Koloniale Petroleum Maatschappij for the last three years, has resigned from that organization and will return to the United States from Batavia, Java, in October.

Dr. T. L. GLEDHILL, assistant geologist of the Ontario Department of Mines, has resigned his position. He had been connected with the department for fifteen years and is recognized as an expert on the Pre-Cambrian formation.

EDWARD B. DURHAM, who was recently engaged in supervising the manufacture of gold dredges for Fairbanks, Alaska, for U. S. Smelting, Refining & Mining, is now in Hurley, N. M., designing a new concentrator for Nevada Consolidated Copper.

FRANK SCHWARZENBERG has been named chief mining engineer of Quincy Mining, in the Michigan copper district. Mr. Schwarzenberg, who has been on the Quincy staff for some time, succeeds NILS EILERTSON, who resigned recently to accept a position with Noranda Mines.

NORBERT F. KOEPEL has been appointed superintendent of milling operations at Portrerillos, Chile, for Andes Copper. Mr. Koepel, a graduate of the Michigan College of Mining and Technology, was in charge of the construction of the experimental mill at the property.

W. R. PHIBBS, general superintendent of the Provo, Utah, plant of the Columbia Steel Corporation during the last four years, has been promoted to general manager of all the Utah operations of the company. C. T. KEIGLEY succeeds Mr. Phibbs as general superintendent.

GLENN L. ALLEN, metallurgical engineer for San Francisco Mines of Mexico, Ltd., at San Francisco del Oro, Chihuahua, Mexico, is in New York. He will visit a number of mines and flotation plants in the Western part of the United States and Canada before returning to Mexico.

J. F. CALLBREATH, secretary of the American Mining Congress, is in California arranging for the meeting of the A.I.M.E., the Mining Congress, and the mineral committee of the California Development Association, which will be held in Los Angeles in September.

J. F. CALLBREATH

Dr. GEORGE OTIS SMITH, Director of the U. S. Geological Survey, and president of the A.I.M.E., is making a second trip to the West. He will address the Columbia section of the Institute at Spokane on July 20. He then will proceed to Seattle, where he will be the week-end guest of mining engineers there at Mount Rainier. On July 23 he will attend a luncheon to be given by Seattle organizations interested in mining and general development. The principal purpose of Dr. Smith's Western trip is to present a paper on July 24 before the meeting of the American Bar Association in Seattle. He has entitled his address "Brakes for the Mineral Industry." Among other things he will discuss the effect of the Sherman law on the mineral industries. On his return Dr. Smith will visit the Montana section at Butte and the Lake Superior section at Duluth.

OBITUARY

JACKSON C. MCCHRYSTAL, consulting mining engineer, died suddenly at Salt Lake City on July 10. Mr. McChrystal was formerly manager of the Packard interests, that controlled the Gemini, Ridge & Valley, Eagle & Bluebell, Eureka Hill, Godiva, and Eureka Mines properties, in the Tintic district of Utah. At the time of his death he was 62 years old. He was a graduate of the Michigan School of Mines and Technology, and a charter member of the Utah chapter of the American Mining Congress. He was a director of the organization from 1915 to 1924, when he retired. Mr. McChrystal was also a member of the University, Alta, and Country clubs, of Salt Lake City. He was survived by his wife, son, and daughter.

M. FRANK PERRY, a retired mining engineer who had lived at Whitney Point, N. Y., for the last fifteen years, died at Binghamton, N. Y., on June 23 from peritonitis. He was 71 years old, and is survived by his wife. Mr. Perry did not set out in life to be a mining engineer, but became interested in that profession during a trip to the Western states at the age of 40. He then took a correspondence course in mining and went to Mexico in 1899 in association with Charles Butters. In 1902, he became manager of the Central Mines of Minas Prietas, later reorganized under the name Mines Company of America, under the Butters proprietorship. During the Mexican revolution of 1910 Mr. Perry went to Salvador, dividing his time between the managership of a property there and his Mexican interests. In 1913 he retired, owing to ill health. Mr. Perry was particularly proud of his welfare and social work in Mexico. This resulted in an unusual co-operation between labor and management, with resultant reduction of costs and improvement in the social condition of the men under him.

MARKET AND FINANCIAL NEWS

Spanish Lead Consortium

THE Spanish government has been occupied for more than a year by the difficulties of the domestic lead industry, according to U. S. Department of Commerce reports. As Spain produces about 50 per cent of the total European lead output, the effect of lower prices has been felt to a marked degree in that country, and many miners have been thrown out of employment. Naturally, the small mines which do not maintain their own establishments for ore treatment have suffered most. Although these so-called "free" mines are estimated to account for only about 30,000 of the more than 200,000 tons of lead produced annually by Spain, their situation and the general depression of the industry induced the government as long ago as May, 1927, to take emergency steps toward relief. The government provided for a credit of 3,000,000 pesetas in accordance with the decree of April 30, 1924, which specified that syndicates could advance to participating mines a sum equal to the production cost. The maximum cost was set at 800 pesetas per metric ton. It was contemplated that these advances would be returned from the profits to be made in the conversion of ore in the plants which the syndicates were to establish.

Provision to make these advances to the mines was to be effective for one year, beginning July 1, 1927. As the end of this period is in sight and the lead industry is still, in the government's opinion, in need of protection, a more inclusive measure has been adopted under royal decree of March 9, 1928. The aid of the state through advances to the syndicates is not continued, but, instead, the industry is further consolidated by the formation of a lead "consortium," to which monopolistic privileges are granted in the Spanish market.

Objects of the Consortium

The expressed objects of the consortium are the purchase and sale of all lead, in bars or manufactured form, which the national market consumes. Purchase is to be made monthly from the entities composing the consortium, in the proportion in which they have sold in the national market in 1927. The decree further states that the consortium shall have as its functions the purchase and sale of lead in bars (and of silver) required by the national market; purchase and sale of old lead; purchase and sale of manufactured lead (tubes, sheets, shot) required by the national market; and administration of a reserve fund and a special fund for aid to the industry.

The consortium will be governed by a council of administration, including a representative of the mine Arrayanes, the presidents of the two syndicates, and four representatives of the mining, treating, and manufacturing entities—all to be of Spanish nationality or to have lived at least nine years in Spain. The remainder of the council is to be made up of three representatives of the state, one of whom shall be president of the consortium and have double vote in deliberations.

Lead Prices Fixed Monthly

The participating ore-treating companies must, according to their zones, treat the ore from Arrayanes and of the two syndicates, the terms to be periodically formulated by the council of administration. Prices of lead in bars bought by the consortium from the member companies shall be fixed monthly by the council, by deducting such expenses as transportation, insurance, and duties from the average price quoted by the London Metal Exchange for the month of delivery. The consortium will have the exclusive privilege of supplying lead required by enterprises which enjoy national protection; also that for urban installations for water and other fluids.

Sales prices will be fixed by the Ministry of Fomento on such a basis as to yield a profit to the consortium, and a portion of the profits shall be set aside to constitute a fund to be used in granting aid to the syndicates. This fund will take the place of the government credit provided earlier and is to be used in the same manner. If prices of ore increase to an extent to provide a profit to the mines composing these syndicates, provision is made for retaining part of these profits until the advances from the fund are repaid.

The consortium is to be of indefinite duration. Members may not withdraw without giving one year's notice, and such notice may not be given until after the expiration of at least five years. The necessary capital for its establishment, purchase, manufacture of lead, and other purposes may be obtained from bank loans guaranteed by the credit of the consortium, or from loans by enterprises constituting the consortium, bearing current interest rates. The Ministry of Fomento is required to adopt necessary measures for immediate formation of the consortium.

STATISTICAL NOTES

Anaconda Copper, Phelps Dodge Corporation, and Cerro de Pasco Copper Corporation have announced higher dividend rates in recent weeks. Anaconda has increased its quarterly rate from 75c. to $1 per share, effective with its disbursement scheduled for Aug. 20, to shareholders of record July 14. Phelps Dodge increases its $1.50 quarterly payment to $2 per share with the payment scheduled for this month. Cerro de Pasco adds 25c. per share to its regular $1 quarterly disbursement announced for payment Aug. 1, to shareholders of record July 12. Presumably, the higher dividend rates are resulting from increased earnings occasioned by the recent improvement in the price for copper.

Howe Sound Company, operating the Britannia mine, in British Columbia, and the Calera and El Potosi mines, in Mexico, reports net income of $559,154 in the first quarter of 1928, compared with $452,360 in the last quarter of 1927. Production for the first quarter of 1928 is compared with that of the first quarter of 1927 in the accompanying tabulation:

	Fourth Quarter, 1927	First Quarter, 1928
Gold, oz.	3,018	3,050
Silver, oz.	808,542	882,151
Copper, lb.	9,242,919	9,438,600
Lead, lb.	19,180,971	19,560,036
Zinc, lb.	13,177,105	14,260,462

Granby Consolidated Mining, Smelting & Power Company, Ltd., compares its operations in the first quarter of 1928 with those in the first quarter of 1927 in the accompanying tables.

Profit-and-Loss Statement

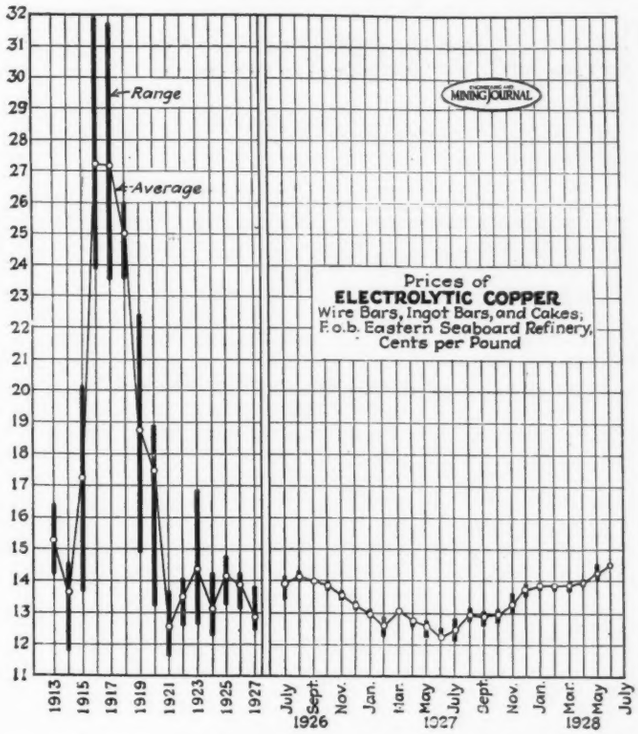
	First Quarter 1928	First Quarter 1927
Value of copper produced	$1,871,905	$1,767,264
Operating costs	1,369,909	1,435,916
Operating income	$501,996	$331,347
Miscellaneous income	60,641	28,849
Total income	$562,637	$360,197
Less bond interest	9,031	66,249
Net income (before depreciation and depletion)	$553,605	$293,948

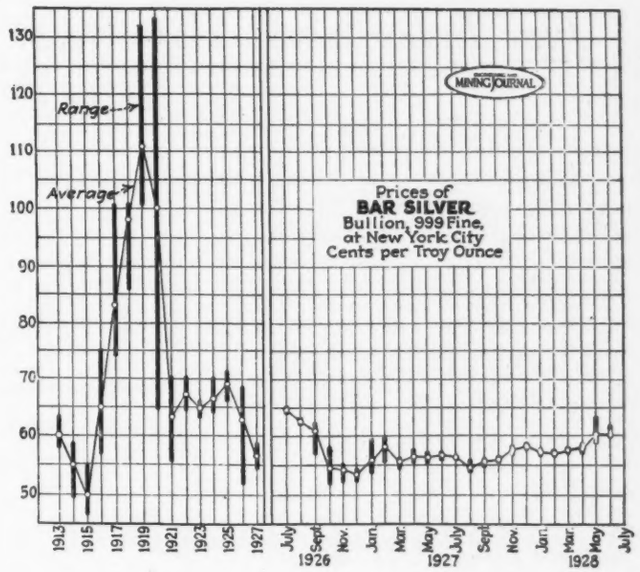
Production and Costs

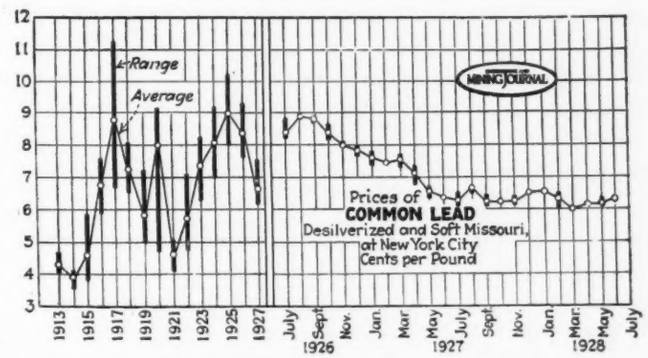
	First Quarter 1928	First Quarter 1927
Net pounds of copper produced	13,561,345	13,563,591
Average monthly production	4,520,448	4,521,197
Average costs in cents per pound	9.654	10.374

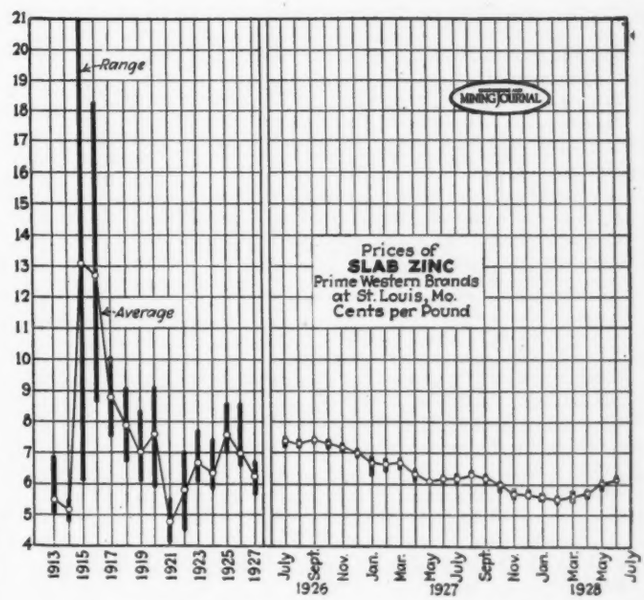
The net income as stated is equivalent to $1.25 per share of stock outstanding on March 31, 1928, against $0.66 per share of stock outstanding on March 31, 1927.

Metal Price Curves

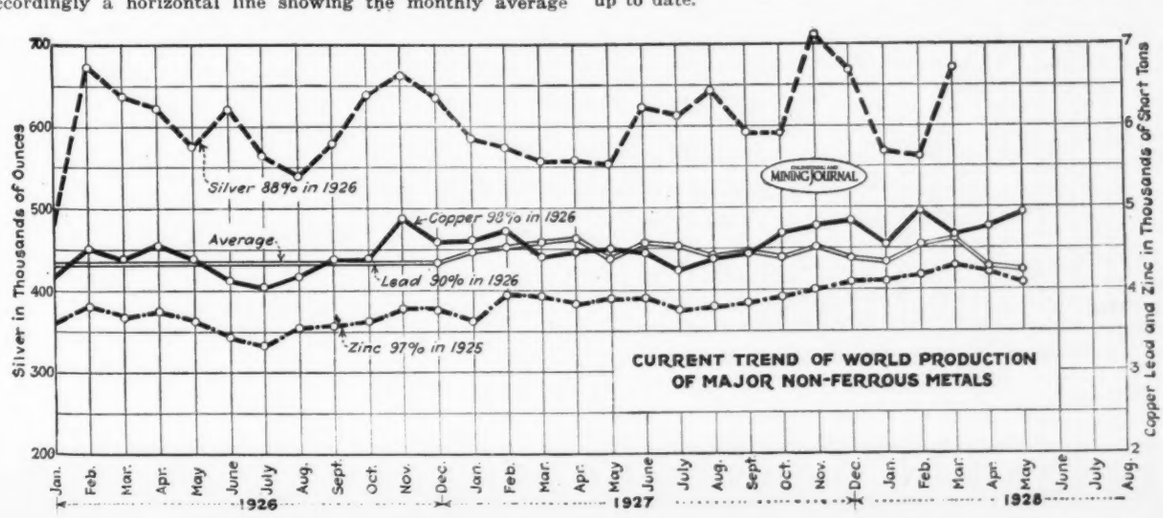

Range
Average
Prices of
ELECTROLYTIC COPPER
Wire Bars, Ingot Bars, and Cakes;
F.o.b. Eastern Seaboard Refinery,
Cents per Pound
MINING JOURNAL
1913 1915 1917 1919 1921 1923 1925 1927
July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July
1926 1927 1928







THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly a horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.


Silver in Thousands of Ounces
Copper Lead and Zinc in Thousands of Short Tons
Silver 88% in 1926
Average
Copper 98% in 1926
Lead 90% in 1926
Zinc 97% in 1925
CURRENT TREND OF WORLD PRODUCTION
OF MAJOR NON-FERROUS METALS
MINING JOURNAL
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug.
1926 1927 1928

Review of Current Statistics

June Index Number of Metal Prices Above 100 for First Time Since March, 1927

By Homar L. Johnson
Assistant Editor

AFTER remaining below parity for fourteen months, *Engineering and Mining Journal's* Weighted Index of Non-Ferrous Metal Prices registered 100.16 for June. Higher prices for copper, lead and zinc are reflected in the advance of the index number, although price declines in tin and silver partly offset the advance. Aluminum and nickel were unchanged. The last previous month to see the index above 100 was March, 1927, when the number settled at 100.84. The relative positions of the various metals comprising this weighted index, as of March, 1927, and June, 1928, provide an interesting comparison. Copper is roughly 1½c. per pound higher than in March, 1927; lead is off 1¼c.; silver is up 4¾c. per ounce; zinc is slightly more than ½c. per pound cheaper; aluminum and tin are 1.7c. and 21¼c. per pound, respectively, lower than in the previous above-100 month. The June average price for copper was 14.527c., the highest monthly figure since January, 1925; and Straits tin at 47.938c. per pound reports the lowest monthly average price since July, 1924.

Copper Production Higher

World production of copper for May was 153,414 tons, a new record, although the daily rate reduces to a lower figure than that shown in February of this year, a condition resulting from the variation in the number of days in the months under consideration. Daily world production rates of lead and zinc were each slightly lower than in April. *Engineering and Mining Journal's* Index of Productive Operations in Metal Mining Industries in the United States which appeared in the issue of June 30 shows that non-ferrous metal production for the first five months of 1928 is at an appreciably lower level than that recorded during the corresponding periods of 1925, 1926 and 1927. An interesting feature of the productive operations index is the consistent relative depression shown during the late summer months, apparently when the migratory labor supply is harvesting the western grain crop. It will be of interest to observe the projection of the curve this summer and to see—in the face of the present market situation—if domestic production will show the additional decline that past behavior of the index predicates.

All three Weighted Indices of Mining Company Share Valuations declined in June. The Mining-Smelting-Manufacturing Index slumped from 206.4 in May to 199.5 for June. The decline was shared by all constituent members with the exception of American Metal, which remained unchanged. Anaconda was the leader in the decline of this group. Of the fourteen members of the Copper group, Chile alone advanced. Leaders in the decline were Kennecott, Nevada Consolidated, United Verde Extension, and Inspiration. U.V.X. declined from $23 to $14.25 per share during the period under review; apparently the action of the company in optioning its properties to Newmont—and later canceling that option—was not accepted as bullish tidings by traders on the Curb. The decline in the Index number of the thirteen miscellaneous mining companies amounted to 6.4 points and was featured by the continued persistent decline of Hollinger, a decline that has taken market quotations on this stock from $18.05 to $13.75 per share in six months. Other declines of moment were recorded by St. Joe Lead, Lake Shore, Howe Sound, and Silver King Coalition. Advances were registered by Cerro de Pasco, Homestake, Premier Gold, Tintic Standard, and Hecla Mining.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54

	1926	1927	1928
November	104.21	96.22	——
December	102.31	98.30	——
January	112.66	100.46	97.54
February	111.91	100.01	96.73
March	108.95	100.84	96.22
April	105.93	98.63	97.14
May	105.43	96.41	99.05
June	106.68	95.55	100.16

Share quotations, in general, of all classes of stocks were weaker in June. That mining stocks should recede from their high quotations of late May was not unexpected. Copper mining company shares, as well as those of the mining-smelting-manufacturing group, shared, with the "motors," the distinction of offering greatest resistance to the general downward movement of share quotations on the various stock exchanges. No fundamental change has occurred in non-ferrous metal statistics. The increase in copper production is unlikely to assume large proportions in the immediate future, and the price appears quite firmly established. Zinc production curtailment continues in effect in the Tri-State district, and the domestic lead situation is only slightly weaker, statistically.

Non-Metallic Index Declines

Engineering and Mining Journal's Weighted Index of Non-Metallic Mineral Prices declined from 106.21 in May to 104 in June, the lowest point since July, 1927. A price war that is raging between the leading interests of the borax industry has resulted in a reduction in the price of borax by some 30 per cent. The only other change reported among the non-metallic products included in the index is an advance in the price of gravel fluorspar, 85-5 grade, in the Kentucky-Missouri fields, from $16 to $16.50 per ton.

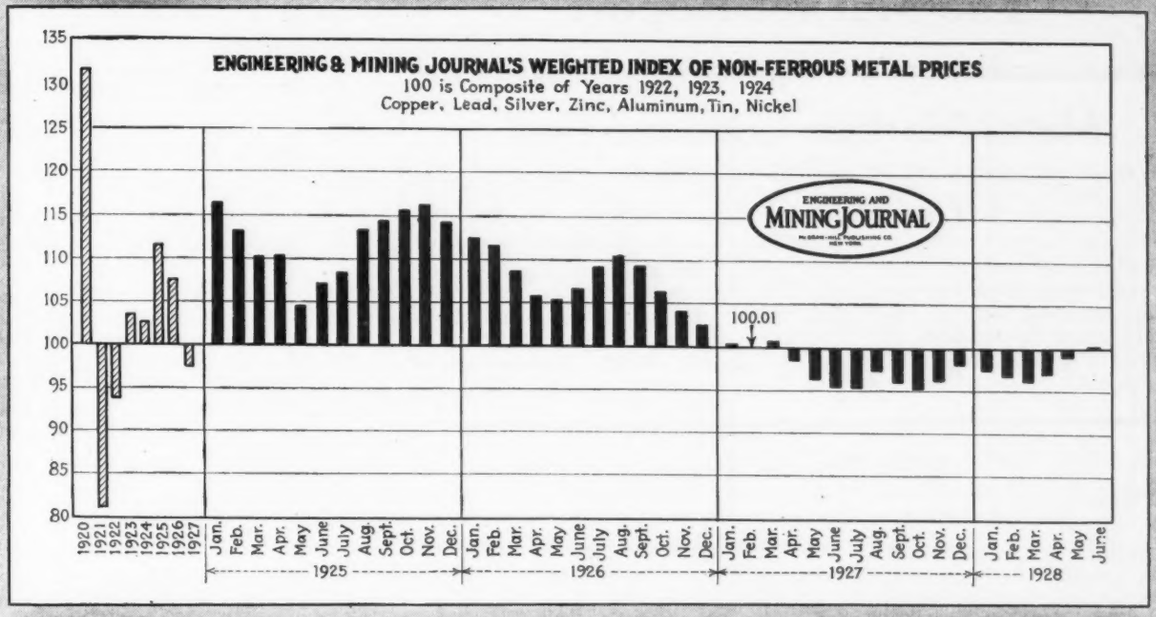
Current Statistics of Production and Stocks of Copper, Lead and Zinc

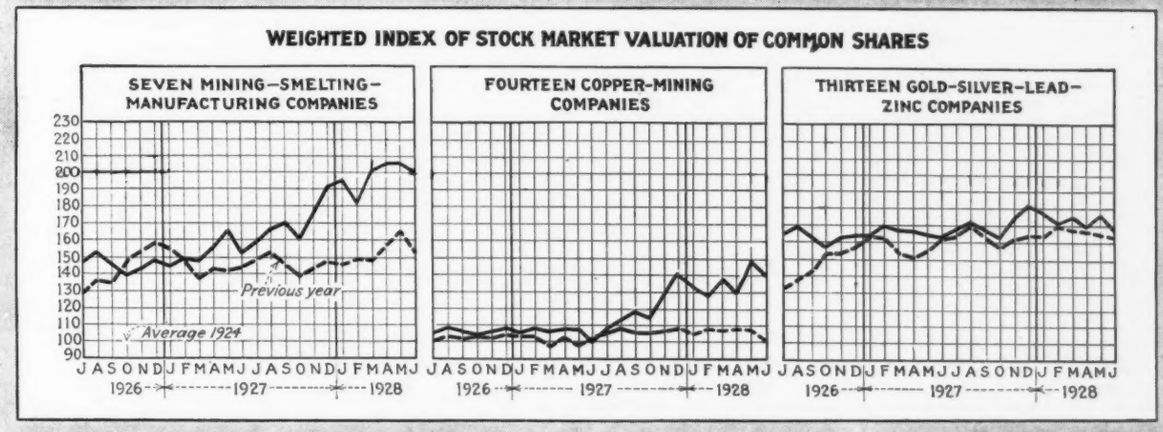
Data from American Bureau of Metal Statistics

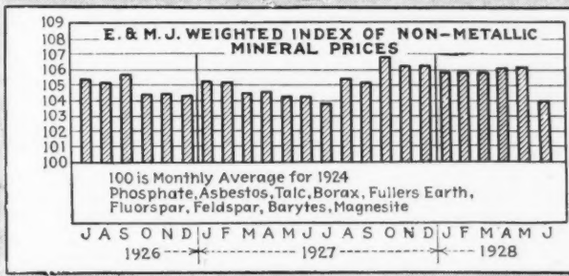
Figures Represent Short Tons

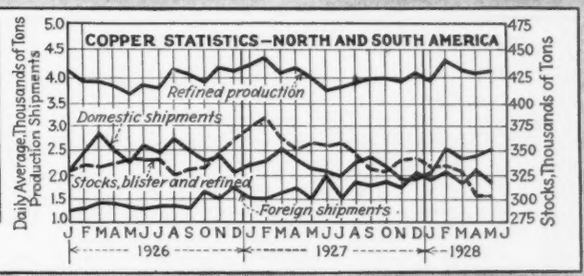
	1927		1928		
	Average	May	March	April	May
COPPER—North and South America					
Production, refined, daily average	4,045	4,051	4,160	4,094	4,169
Domestic shipments	68,737	73,976	72,642	72,234	79,103
Foreign shipments	53,489	55,636	55,970	64,989	56,738
Stocks, blister and refined	351,611	350,153	329,708	308,285	308,043
LEAD—United States and Mexico					
Production, smelter, daily average	2,513	2,553	2,608	2,288	2,349
Production, U. S. mines, daily average	1,798	1,837	1,872	1,671	1,653
Imports into U. S. A.	13,451	7,217	12,556	10,314	.....
Stocks, smelter and refinery	156,878	175,230	173,411	161,207	.....
ZINC—United States					
Production, daily average	1,681	1,655	1,803	1,783	1,723
Domestic deliveries	45,811	45,560	51,856	46,517	49,818
Exports, slab zinc	3,468	1,910	2,558	2,620	.....
Exports, ores and dross	4,424	7,451	1,898	155	.....
Stocks	37,602	42,046	41,529	44,759	45,225
World Production Rate (Daily average)					
Copper	4,543	4,488	4,672	4,781	4,949
Lead	4,514	4,409	4,629	4,339	4,247
Zinc	3,910	3,866	4,259	4,212	4,108

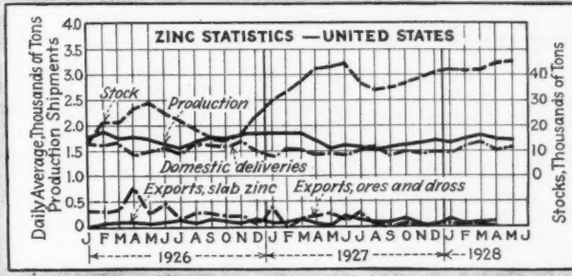
E.&M.J. Statistics of the Mining Industries

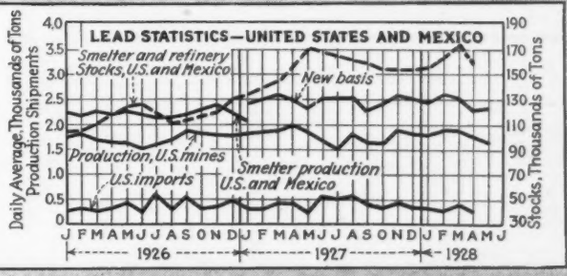





E. & M. J. WEIGHTED INDEX OF NON-METALLIC MINERAL PRICES
100 is Monthly Average for 1924
Phosphate, Asbestos, Talc, Borax, Fullers Earth, Fluorspar, Feldspar, Barytes, Magnesite
1926
1927
1928







The Market Report

Metal Markets Continue Dull

Prices Well Maintained, However, for Copper, Zinc, and Tin—Lead and Silver Slightly Lower

New York, July 11, 1928—The hot weather of the last week has made metal sellers and buyers think more of vacations than business, with the result that the total volume of business done has again been well below normal. Prices are in general unchanged, though a weak foreign market, coupled with the lack of demand here, caused a drop in the price of lead in New York to 6.20c., after 6.30c. had been maintained for many weeks. Silver is also fractionally off, at 59c. today. There is no weakness in copper or zinc, producers of the first-named being glad of the let-up in demand after the big business of the last two months, and the zinc sellers seeing no point in offering the metal below 6.20c., with $40 ore, and also being fairly certain that their customers are operating on a hand-to-mouth basis. No change of importance has occurred in the minor metals or non-metallic minerals, with the exception of the drop in the price of bismuth.

Daily Prices of Metals

July	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
5	14.525@14.55	46.00@46.125	6.30	6.125	6.20
6	14.525@14.55	46.00@46.125	6.30	6.10	6.20
7	14.525	46.00@46.125	6.275@6.30	6.10	6.20
9	14.525@14.55	46.375	6.20	6.10	6.20
10	14.525	46.25	6.20	6.05@6.075	6.20
11	14.525	46.25	6.20	6.075	6.20
	14.531	46.177	6.248	6.094	6.200

Average prices for calendar week ending July 7, 1928, are: Copper, 14.530; Straits tin, 46.088; N. Y. lead, 6.298; St. Louis lead, 6.125; zinc, 6.198; and silver, 59.350.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
5	63	63 1/4	68 1/2	206	203 5/8	20 1/2	20 7/8	25 7/16	25 1/4
6	62 3/4	62 7/8	68 1/2	206 5/8	204 1/2	20 3/8	20 7/8	25 5/16	25 3/16
9	62 3/4	62 7/8	68 1/2	206 3/4	204 3/8	20 3/16	20 11/16	25 3/16	25 1/16
10	62 7/8	63 1/16	68 1/2	209 1/8	206 5/8	20 1/8	20 5/8	25 1/16	24 15/16
11	63 1/8	63 3/8	68 3/8	209 1/2	206 1/2	20 1/4	20 3/4	25 1/4	25

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
5	4.86 7/8	59 1/8	27 1/4	84s10½d	9	4.86 5/8	58 7/8	27 1/16	84s10½d
6	4.86 3/4	59 1/4	27 1/4	84s10½d	10	4.86 3/4	58 7/8	27 1/16	84s10d
7	4.86 5/8	59 3/8	27 5/16	.....	11	4.85 7/8	59	27 3/16	84s10½d
					Avg.		59.083		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Copper Still 14¾c. in the East

The situation in copper is entirely unchanged, with producers a unit in offering metal at 14¾c. in the East, and at 14⅞c. for deliveries in the North-Central states. All are so well sold up with, and even ahead of, production, that they are not seeking business, but a fair volume of sales is reported, especially today. Practically all of the orders have been for either July or August delivery, no interest being observed in September, though a fair quantity for that delivery was purchased in the last buying wave. Both July and August requirements have been pretty well provided for, so it seems likely that until consumers begin buying for fall consumption the copper market will be a tame affair, with sales confined to rather small tonnages for early delivery, as has been the condition in the last two weeks.

The foreign demand has been as quiet, comparatively, as the domestic, with the export association selling around 1,000 tons a day at the unchanged price of 15c., c.i.f. A little more interest has been observed the last two days, however, and London prices rose a little today, but this increase is considered of no importance, on this side at least.

Lead Price Declined

The only noteworthy incident occurring in a featureless lead market week was the price reduction of $2 per ton, effective July 9, in the American Smelting & Refining Company's contract price. Thus lead returns to the 6.20c. per pound price in New York, from which it had been advanced on May 29. Continued weakness abroad, which brought the London quotation for spot lead close to the point where foreign-bullion lead might profitably enter the domestic market, is given as the primary cause of the price reduction. Some authorities, however, contend that the domestic situation has also been a factor. The decline could not have been entirely unexpected, for prices in the Middle West have been easier all week and at least one sale at a concession from the 6.30c. level in New York was reported late last week. The St. Louis price is not firmly established as yet. One seller is holding at 6.10c. and another at 6.075c., and reports are heard that chemical lead is available at 6.05c. East St. Louis. Indications are that a slight increase in domestic production

will be shown in June statistics to be released in the next few days, although total stocks on June 1 declined another 2,000 tons, according to the final figures released by the American Bureau of Metal Statistics yesterday.

Zinc Quiet at 6.20c.

The volume of zinc sales has been well below that of the last two or three weeks, but the price continues steady at 6.20c., St. Louis, for July shipment. August is nominally 6.25c., but this price seems untested on actual business. Rumors of sales by dealers at 6.175c. have been heard in the last day or two, but producers show no signs of making any such concession. The June statistics of the American Zinc Institute follow, the figures being in tons of 2,000 lb.:

Stock, June 1	45,225
Produced	50,825
Shipped	51,582
Stock, June 30	44,468
Shipped from plants for export	1,802
Metal sold, not yet delivered, June 30	11,687
Total retort capacity, June 30	122,920
Average number retorts operating in June	66,079
Number retorts operating June 30	65,680

The fact that the metal sold but not yet delivered dropped about 5,000 tons during the month indicates an underbought condition of the consumers, a conclusion that gibes with the fact that most of the recent business has been for prompt shipment.

Tin Holds Steady Above 46c.

The entry of consumer buying in larger proportion in the domestic tin market has resulted in the exhibition of a much firmer tone by this metal. Price has advanced slightly during the week, and today a continuation of the firmer tendency is indicated. No change of importance has occurred in the statistical position.

Silver Lower and Steady

During the last week silver has declined gradually, which is accounted for by sales abroad for China account. India has shown some interest as a buyer both here and abroad, which has apparently helped to steady the market at the lower level.

Mexican Dollars (Old Mexican pesos): July 5th, 44⅝c.; 6th, 44¼c.; 7th, 44⅞c.; 9th and 10th, 44⅜c.; 11th, 44½c.

Foreign Exchanges Lower

High interest rates in New York have had a depressing effect on the leading European exchanges. Closing cable quotations on Tuesday, July 10, were as follows: Francs, 3.91⅛c.; lire, 5.24⅛c.; and marks, 23.865c. Canadian dollars, ¼ per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, all positions, 9½c. Cookson's "C" grade, spot, 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up. Prices reduced from $2.10 and $2.25, respectively, on July 9, following a decline in London from 9s. to 7s. 6d. per lb.

CADMIUM—Per lb., New York: 65c. @75c., according to quantity.

IRIDIUM — Per oz., $275@$300 for 98@99 per cent sponge and powder. Market dull.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $46@$49. Small lots bring up to $55. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $73.50@$74 bid, $75.50@$76.50 asked. Market very quiet.

QUICKSILVER — Per 76-lb. flask, $121@$123, depending on quantity. San Francisco wires $126.33.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of July 7.

Metallic Ores

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn; 35@38c. Caucasian, washed, 53@55 per cent, 38@40c. Chemical grades unchanged from quotations in the July 7 issue.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.75@$10.85, Western scheelite, $11@$11.25.

Chrome, Iron, Tantalum, and Titanium ores are unchanged from quotations in the July 7 issue.

No Change in Joplin Ore Prices

Joplin, Mo., July 7, 1928.

Blende	Per Ton
High	$41.80
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	40.00
Fines and slimes, 60 per cent zinc	36.00@ 39.00
Average settling price all zinc	38.59

Galena	
High	$85.10
Basis 80 per cent lead	$82.50@ 83.50
Average settling price, all lead	83.98

Shipments for the week: Blende, 7,524; galena, 1,478 tons. Value, all ores the week, $414,510.

Buyers could obtain but 7,250 tons of blende in each of the last two weeks, but by persistently stating that they needed a larger tonnage producers today increased their sales to 9,750 tons, which total was 3,390 tons more than was produced, with the holiday intermission.

With slab zinc at the highest average price since Sept. 24, 1927, the metal market has regained stability at a price level that is fairly satisfactory to producers of zinc ore.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the July 7 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic)—Per lb., 4c. Fair demand.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the July 7 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $32 f.o.b. furnace.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent, 96@98c. f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal are unchanged from prices in the July 7 issue.

Rolled Metals

Copper, Lead, and Zinc Sheets are unchanged from prices in the July 7 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of July 7.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $17; basic, $15.75@$16; No. 2 foundry, $16.50@$16.75.

Steel—Base prices per gross ton, Pittsburgh, billets rerolling, $32; slabs, $33; plates, structural shapes, and soft steel bars, per pound, 1.85@1.90c.

Coke—Per gross ton, Connellsville furnace, contract, $2.75@$3; spot, $2.60@$2.75. Connellsville foundry, contract, $3.50@$4.85; spot, $3.50@$4.50. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended July 7, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	69¼	67	68¾	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	5	4¾	4¾	Ja. 19, Ja. 31 SA	0.25
Cal. & Ariz	New York	100¾	96⅝	97⅞	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	23¾	22½	23	My. 31, Je. 15 Q	0.50
Cerro de Pasco	New York	79½	75	78⅜	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	46¼	44¼	45⅞	Je.6, Je.30 Q	0.62½
Con. Coppermines	N. Y. Curb	12	11	11		
Copper Range	Boston	19⅜	18	19	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*46	*40	*46		
East Butte	Boston	2⅜	2⅜	2½	Dec., 1919	0.50
Granby Consol	New York	54⅞	52¾	54¼	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	109¾	97	107⅜	Je. 15, Jl. 2	1.00
Howe Sound	New York	60½	57⅜	59	Je.30, Jl.16, Q	1.00
Inspiration Consol	New York	22⅜	21⅝	22½	Apr. 1927 Q	0.25
Isle Royale	Boston	20¼	17	19¼	Fe.28, Mr.15 SA	0.50
Kennecott	New York	92¼	88¼	91¼	Jl. 1, Jl. 2 Q	1.25
Magma Copper	New York	53¼	51	52½	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅜		
Miami Copper	New York	20⅛	19⅞	20⅛	Au.1, Au.15, Q	0.37½
Mohawk	Boston	60	57	59½	Ap. 30, Je. 1 Q	1.00
Montana-Idaho	Spokane	*20	*17½	*17½		
Mother Lode Coal	New York	2⅞	2½	2⅝	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	23¾	22⅛	23⅛	Je.15, Je.30 Q	0.375
New Cornelia	Boston	29	27⅛	28	My. 4, My. 21 Q	0.50
Noranda	N. Y. Curb	64	46¼	54⅜		
North Butte	Boston	3⅛	2⅜	2½	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*84	*75	*84	Sept., 1926	0.03
Old Dominion	Boston	15⅛	11⅛	14	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	....	....	135	Je.25, Jl.22 Q	2.00
Quincy	Boston	46	33⅛	35	March, 1920	1.00
St. Mary's Min. Ld	Boston	31⅛	28	31	Ap.1928 A	2.00
Seneca Copper	New York	2⅞	2⅜	2⅞		
Shattuck-Denn	N. Y. Curb	15⅜	14⅜	15		
Tenn. C. & C	New York	14½	13⅜	13⅞	My.29, Je.15,Q	0.12½
United Verde Ex	N. Y. Curb	16	14⅛	14½	July 6, Q	0.50
Utah Copper	New York	159	159	159	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.37½	1.32½	1.35		
NICKEL-COPPER						
Internat. Nickel	New York	98¼	90½	95⅞	Je.14, Je.30 Q	0.50
Internat. Nickel pfd	New York	....	....	115¼	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*3½	*3⅜	*3⅜	June, 1927	0.005
National Lead	New York	121	120½	120½	Je.15, Je.30 Q	1.25
National Lead, pfd. A	New York	144½	144½	144½	Je.1, Je.15 Q	1.75
National Lead, pfd. B	New York	120½	120½	120½	Jl. 20, Au. 1 Q	1.50
St. Joseph Lead	New York	42¼	41¼	42	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	26⅞	23⅛	26⅛	May, 1917	1.00
Am. Z. L. & S. pfd	New York	88	84⅞	87	Nov., 1920	1.50
Butte C. & Z	New York	7⅜	6⅞	7	De., 1926	0.50
Butte & Superior	New York	13⅜	11⅛	13	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3⅜	3⅛	3⅜	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	13⅛	13⅛	13⅛	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	16⅞	16⅜	16⅝	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	....	....	100	Mr. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	218½	213½	218¼	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	20.25	18.50	20.15		
United Zinc	N. Y. Curb	*60	*60	*60		
Yellow Pine	Los Angeles	*27½	*27½	*27½	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	3⅛	3⅛	3⅛		
Ankerite	Toronto	*40	*40	*40		
Barry-Hollinger	Toronto	*71	*59	*60		
Central Manitoba	Toronto	1.44	1.18	1.31		
Cresson Consol. G	N. Y. Curb	1⅛	1⅛	1⅛	Je.30, Jl.10 Q	0.10
Dome Mines	New York	9	8⅛	8⅛	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.70	†1.68	....	My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*10½	*9½	*9½		
Hollinger Consol	Toronto	14.00	13.00	13.75	Je.27, Jl.14 FW	0.10
Homestake Mining	New York	72	72	72	Jl.20, Jl.25 M	0.50
Kirkland Lake	Toronto	1.54	1.20	1.33		
Lake Shore	Toronto	23.00	22.25	22.50	Je.1, Je.15 QX	0.20
McIntyre Porcupine	New York	24½	24¼	24½	May1, Je.1 Q	0.25
Portland	Colo.Springs	†*16	†*15	....	Ap., 1927	0.02
Rand Mines	New York			39⅜	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	2.55	2.50	2.55		
Teck-Hughes	Toronto	11.10	10.85	11.00	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*45	*40	*40	Dec., 1926	0.02
Tough-Oakes	Toronto	*26	*24½	*25		
Vipond Cons	Toronto	*52½	*45	*45	April, 1927	0.03
Wright-Hargreaves	Toronto	4.00	3.80	4.00	Ap.13, My.1 Q	0.05
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	19⅞	19	19		
Con. Cortez	N. Y. Curb	*29	*28	29		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	....	....	15	Ap.18, Ap.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2 3/16	2 3/16	Je.14, Jl.3	0.06
Tonopah Belmont	N. Y. Curb	*90	*90	*90	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	....	....	*12	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	4 3/16	4 1/16	4 1/16	Mar.31, Ap.21 SA	0.07½
West End Consol	N. Y. Curb	....	....	*4	Mar., 1923	0.05
Yukon Gold	Boston Curb	*75	*59	*75	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	1.00	*89	*89	May, 1920	0.03
Castle-Trethewey	Toronto	*55	*55	*55		
Coniagas	Toronto	4.75	4.20	4.25	May, 1924	0.12½
Keeley	Toronto	*61½	*60	*60	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	....	....	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.75	3.33	3.65	My.20, Je.13 SA	0.12
Nipissing	N. Y. Curb	4	3⅜	3⅜	Je.30, Jl.20Q	0.075

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅛	3⅛	Ap., 1927	0.12½
Bingham Mines	Boston	75	41½	43	Je.23, Jl.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	140	135	140	June 10, MX	0.75
Cardiff M. & M	Salt Lake	*65	*65	*65	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.50	4.40	4.40	Ja.10, Fe.1 K	0.10
Consti'n Mng. & Mill'g.	Spokane	*20	*.5	*20		
Erupcion	Boston Curb	....	....	*28	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.15	2.05	2.05		
Federal M. & S	New York	....	....	125	Je., 1927	10.00
Federal M. & S. pfd	New York	98¼	98	98	My.25, Je.15 Q	1.75
Hecla Mining	N. Y. Curb	14¾	14⅜	14⅜	My.15, Je.15 Q	0.15
Highland-Surprise	Spokane	*12	*12	*12		
Iron King Mining	Salt Lake	*78	*75	*75		
Keystone Mining	Salt Lake	*26	*26	*26	Fe., 1926	0.07½
Lucky Jim	Spokane	*31	*31	*31		
Lucky Tiger-Com	Kansas City	†7.85	†7.70	....	Je.7, Je.20MX	0.07
Mammoth Mining	Salt Lake	1.40	1.40	1.40	De., 1926	0.25
North Lily	Salt Lake	7⅜	7⅜	7⅜		
Park Utah	New York	12½	11⅜	12	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	†2.00	†1.50	....	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	....	....	*51	June 15 Q	0.03
Silver King Coal	Salt Lake	11.87½	11.50	11.87½	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*16	*12	*16	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*76	*73	*75		
Sunshine M. Co	Spokane	1.20	1.20	1.20	June 20,	0.02
Tamarack-Custer	Spokane	*50	*48	*50	Sept., 1924	0.25
Tintic Standard	Salt Lake	14	14	14	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	4⅛	4⅛	4⅛	Jl.14, Au.1 1926	0.25
IRON						
Bethlehem Steel	New York	56⅜	54½	55⅜	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	110	104½	109	Ap.13, Ap. 25. Q	1.00
Colorado Fuel & Iron	New York	63¼	57	63⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	20½	20	20½	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	55½	54½	55	My. 15, Je.1 Q	0.62½
Republic I. & S	New York	53¼	49⅜	52	My.15, Je.1 Q	1.00
Republic I. & S. pfd	New York	....	....	104	Je. 15, Jl. 2 Q	1.75
Sloss-Sheffield S. & I	New York	105	104	104	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	....	....	115½	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	141	135⅛	140	My.31, Je.29 Q	1.75
U. S. Steel, pfd	New York	142	141	141⅜	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C	New York	...	...	14½	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	...	...	55	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	25⅜	July., 1927	1.45
So. Am. G. & P	N. Y. Curb	3⅛	3⅛	3⅛		
Alum. Co. of Amer	N. Y. Curb	150	140⅜	150		
Alum. Co. of Amer. pf.	N. Y. Curb	109	108¾	108¾	Je. 15, Jl. 1 Q	1.50
Vanadium Corp	New York	77⅛	70	76	My. 1, My. 15 Q	0.75
Patino M. & E	New York	31¼	29⅛	30⅜	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	33	30½	33	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	92	91	91⅞	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	73⅜	67½	72	Jl.14, Au.1 QX	1.75
Texas Gulf	New York	71⅜	65½	70½	Je.1, Je.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	49⅜	47⅜	49¼	Au. 21, Se 1 Q	0.75
Amer. Metal, pfd. 6%	New York	114½	113½	114½	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York	....	....	125	My.15, Je.1	1.75
Amer. Sm. & Ref	New York	195½	188¾	194	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	135	135	135	Au. 3, Se. 1 Q	1.75
Consol. M. & S	Montreal	266	256	265	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	166⅞	157½	161	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M	New York	48¾	47	47⅜	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	53¼	53¼	53¾	Jl. 5, Jl. 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED June 26, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	38/—	37/6	37/6			
Alaska Treadwell ($25)	122/6	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	67/6	63/9	65/—	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/3	13/9	14/1½	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	4/9	4/6	4/9			
Camp Bird (2s)	4/7½	4/4½	4/7½	April, 1928	16⅔ p.c.	
El Oro (£1)	4/9	4/6	4/7½	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	13/—	12/6	13/—	Jan., 1928	5 p.c.	
Mexican Corpn. (£1)	11/—	10/4½	10/6			
Mexico Mines of El Oro (£1)	30/7½	24/7½	27/6	Dec., 1926	3⅓ p.c.*	
Mond Nickel	183/9	169/4½	183/9	Feb., 1928	7½ p.c.	
N'Changa Copper Mining	16/—	15/9	15/9			
Oroville Dredging (£1)	3/9	3/7½	3/9	Dec., 1923	3¾ p.c.	
Rhodesian Congo Border (£1)	34/4½	27/6	31/3			
St. John del Rey (£1)	12/7½	12/1½	12/3	April, 1928	7½ p.c.	
San Francisco Mines (10s)	28/—	27/—	27/3	July 1928	12½s.	
Santa Gertrudis (£1)	16/6	15/6	16/—	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	13/10½	12/6	13/6	April, 1917	6⅔ p.c.	
S. Amer. Copper (2s.)	2/6	2/—	2/1½	Nov., 1917	75 p.c.	
Tanganyika (£1)	58/9	54/6	57/6	Aug., 1927	7½ p.c.	
Union Miniere de Haut-Katanga (Brussels)	11,525	10,900	10,900	July, 1927	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.